Environmental Integrity Index Methodology

City of Austin

Watershed Protection Department
Environmental Resources Management Division

Water Quality Report Series *May 30, 2002*

COA-ERM 1999-01

ACKNOWLEDGEMENTS

This report was prepared by the Environmental Resources Management Division of the City of Austin's Watershed Protection Department under the general supervision of Nancy L. McClintock, Division Manager

The authorship of this document belongs to a wide-variety of professionals working in the Watershed Protection Department and it's predecessor departments, the Drainage Utility Department and Environmental and Conservation Services Department. Each had a part in the development of the index as well as a role in creation, editing, and reviewing this document. Because this project began and continues to be conducted as a team effort of several sections in the division, the contributions of all of the following staff are recognized as crucial to development and appropriate implementation of the Environmental Integrity Index:

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Purpose

The Environmental Integrity Index (EII) is a tool developed by the City of Austin's Environmental Resource Management Division to monitor and assess the ecological integrity and the degree of impairment in Austin's watersheds. This report describes the EII methodology, documents the EII in the context of similar indices used in a regulatory setting, discusses data from two pilot watershed studies, and provides results from the implementation of the EII method for the City of Austin Watershed Protection Department's Masterplanning process.

Goals and Objectives

The goal of the developers of the EII was to produce a quantifiable method for assessing the water quality condition of Austin's urban and non-urban streams and to provide a baseline from which to evaluate our water resources in order to target protective measures and restoration, thus enhancing the quality of life for the citizens of Austin.

During the development of the EII, the following objectives were pursued:

- To develop an integrated comprehensive method of assessing our water resources by incorporating chemical, physical, habitat quality, and biological assessment components.
- To develop a watershed-scale assessment approach which could be effectively integrated with flood and erosion assessments to achieve a comprehensive method for monitoring and protecting our water resources against water quality degradation, flooding and erosion.
- To develop cost effective monitoring protocols and methods that can be implemented using existing City of Austin Watershed Protection resources.
- To develop indicators which are sensitive to early signs of degradation and environmental changes.
- To develop monitoring and assessment protocols that are scientifically sound and technically feasible.
- To develop monitoring and assessment protocols that are appropriate to Central Texas Ecoregions
- To provide a method for relative prioritization of water quality current needs in the City's watersheds
- To provide an index that may be represented visually and may be easily understood by the general public.

Major Components

To formulate the EII, the designated water uses specified in the Clean Water Act Section 303 [c](2)(A) that are applicable to Austin area creeks were identified and condensed into six protection categories. These categories are aquatic life protection, non-contact recreation, contact recreation, habitat quality, water quality, and sediment quality. Specific parameters under each of these categories were selected after careful review of other state and federal water quality monitoring and assessment protocols, and professional judgement. In particular, the US Environmental Protection Agency (USEPA) Rapid Bioassessment Protocols (Plafkin, et al. 1989) and the Texas Natural Resource Conservation Commission, (TNRCC) Use Attainability Assessment and Physical Characteristic Assessment (TNRCC, 1988) were useful references. However, some of the EII procedures are new or modified from existing state or federal protocols to better reflect Central Texas ecoregions and local conditions. The six major categories are summarized in Table 1, and are as follows:

Contact Recreation (Swimming/Wading)

The suitability of a waterbody for contact recreation use is evaluated using fecal coliform bacteria concentrations, which is an indicator of pathogenic activity. Existing water quality standards are used to develop the score criterion for the EII.

Non-Contact Recreation/Aesthetic

The parameters included in the non-contact recreation field assessment include water surface appearance, litter, odor, clarity, and percent algae cover. Parameter descriptions and scoring for these procedures are included in the Non-Contact section of the report. Trained field observers visually determine all of these measures.

Water and Sediment Quality

Water quality subcomponents are calculated from chemical analysis of grab samples from all study sites. Analytical parameters for water quality include fecal coliform (bacteria), total suspended solids, total dissolved solids, nitrate-nitrogen, orthophosphorus, ammonia-nitrogen, and total hardness. Total hardness is a nonscoring parameter that is used to evaluate the environmental toxicity level of specific parameters in the sediments. Sediment sampling is conducted at one site in each watershed located near the mouth upstream from any backwater deposition impacts. Laboratory analysis of sediments includes metals, PAHs, PCBs, organochlorine pesticides, and grain size. Grain size, acid volatile sulfide, and volatile suspended solids are nonscoring parameters used to interpret the sediment analysis data. Sediment scores from the mouth are used as a subindex in calculating each reach combined scores.

Habitat Quality Index

Parameters used to measure the level of habitat quality include instream cover, epifaunal substrate, embeddedness, velocity/depth regimes, channel alteration, sediment deposition, frequency of riffles, channel flow status, condition of banks, bank vegetation protection, disruptive pressure, anaerobic conditions, and riparian zone width. All of these parameters are scored on a numerical scale using descriptive scoring categories for guidance. Another scoring component of this index is a numerical rating of Stream Stability, which includes the following parameters: landform slope, mass wasting, debris jam potential, entrenchment ratio, bank rock content, cutting and deposition, scouring, rock angularity, rock brightness, attached aquatic vegetation, obstructions, consolidation, bank vegetation protection, and percent stable material.

Aquatic Life Support

Aquatic life support at all of the EII study sites is evaluated by sampling and analyzing the macroinvertebrate community structure, diatom community structure, filamentous algae percent cover, chlorophyll–α, and the presence or absence of fish. The results of the Habitat Quality Index are used to interpret and contextualize the results of the biological community analysis components (benthic macroinvertebrates and diatoms).

Calculation of the EII scores

The six subcomponents (contact recreation, non-contact recreation, water quality, sediment quality, habitat quality, and aquatic life support) are averaged to obtain one EII score for each monitoring site. EII scores range from 0 to 100 and are characterized by using the following eight ranges: very bad (0-12), bad (13-25), poor (26-37), marginal (38-50), fair (51-62), good (63-75), very good (76-87), and excellent (88-100). The masterplan process requires EII scores for both the entire watershed and its smaller subwatersheds or reaches. The drainage area contributing to the reach defines subwatersheds, and reaches are defined as the channel between EII stations. Overall watershed scores are determined by grouping the site-specific scores for each subcomponent at each site together and calculating an average subcomponent score for the watershed. For example, If a watershed has three monitoring sites, then the three-subcomponent scores for water quality would be averaged together to get the watershed water quality score. This process is repeated for aquatic life, non-contact recreation, contact recreation, and habitat quality. Since sediment quality is only evaluated at the watershed's mouth, no averaging is required. These averaged subcomponents scores and the sediment quality score are then averaged together to determine the overall EII watershed score.

1.0 PROJECT BACKGROUND

1.1 Introduction

The City of Austin’s Watershed Protection Department mission is to reduce flooding, erosion and protect the water quality in Austin area watersheds. The Environmental Integrity Index (EII) is a water quality monitoring tool used to assess the ecological integrity and the degree of impairment of Austin’s watersheds. The EII combines biological and physical criteria with chemical and toxicity data to provide a comprehensive assessment of the structure and integrity of the aquatic ecosystem. As part of the City’s masterplan process, the EII scores are integrated with flood and erosion assessments in order to evaluate the current water quality conditions of Austin’s watersheds. The integrated scores have been used to develop a prioritized list of problem areas and will be used in the future to assess the effectiveness of solutions.
In this manner, the EII contributes to the Department's mission to serve the citizens of Austin by using environmentally responsible and cost-effective water resource management to protect lives, property, and the quality of life. Because the EII is cost-effective, comprehensive and direct means of monitoring the health of Austin’s receiving waters, it was also incorporated into the City of Austin’s National Pollution Discharge Elimination System (NPDES) permit program as a Reasonable and Prudent Measure (RPM) for Barton Springs Salamander protection.

1.2 Goals and Objectives

Although the use of the EII for planning is a relatively new proposal, the need for a comprehensive method of assessing water resources has been noted for years. During the era of the Clean Water Act, scientists determined that chemical water analysis, while a necessary monitoring function, is not sufficient to assure that our water resources are protected and functioning properly (Woodley et al., 1993; Davis and Simon, 1995; Karr, 1991). Regional and local regulatory and management agencies that rely on chemical analysis alone for assessing the water quality of aquatic resources may underestimate the extent of degradation or correspondingly overestimate the ecological health of aquatic resources. One study concluded that conventional chemical criteria failed to detect 50% of the impairment in surface waters (Davis and Simon, 1995). This finding is especially relevant to nonpoint source impacts that are cumulative and difficult to quantify by directly measuring chemical water quality. To accurately guide the development of the EII, developers started by identifying unified goals and objectives.

1.3 Goal of EII Development

The goal of the EII developers was to produce a technical and quantifiable method for assessing the current water quality conditions of Austin's watersheds, and to provide a baseline for long term evaluation of our water resources. This tool would identify water quality problems in watersheds and help target possible structural, programmatic and regulatory solutions to maintain or enhance overall water quality.

1.4 EII Development Objectives

- To develop an integrated and comprehensive method of assessing our water resources, incorporating chemical, physical, habitat quality, and biological assessment components.

- To develop a watershed-scale assessment approach which could be effectively integrated with flood and erosion assessments to achieve a comprehensive method for monitoring and protecting our water resources against water quality degradation, flooding and erosion.

- To develop cost effective monitoring protocols and methods that can be implemented using existing City of Austin Watershed Protection resources.

- To develop indicators that are sensitive to early signs of degradation and environmental changes.

- To develop monitoring and assessment protocols that are scientifically sound and technically feasible.

- To develop monitoring and assessment protocols that are appropriate to Central Texas Ecoregions.

- To provide a method for relative prioritization of water quality current needs in the City's watersheds.

- To provide an index that may be represented visually and may be easily understood by the public.

1.5 Overview of the Environmental Integrity Index

The development of the EII began as a Service Improvement Process (SIP) project with the City of Austin's Environmental Resources Management Division. The preliminary development meetings to identifying the pertinent factors or subcomponents for the index occurred in February 1994. After completing a literature review of existing indexes (see Appendix A) and incorporating staff input, six major subcomponents were selected for the integrity index. In formulating the EII, eleven types of designated uses were identified from Clean Water Act (Section 303 [c](2)(A): public water supply; protection and propagation of fish, shellfish, and wildlife; recreation; agriculture; industry; navigation; coral reef preservation; marinas; groundwater recharge; aquifer protection; and hydroelectric power. With the exception of coral reef preservation, all of these uses are applicable to the creeks in the Austin area or their immediate receiving waters. These designated uses were condensed into six-protection categories; aquatic life protection, non-contact recreation, contact recreation, habitat quality index, water quality index, and sediment quality. The relative importance of each subcomponent was determined to be equal. However, the importance of an individual parameter used in evaluating a subcomponent may vary Subcommittees were formed to review existing indices and establish the evaluation methods for each subcomponent and to submit written protocols for review by October 1994. Individual parameters for each subcomponent, both scoring and nonscoring, are summarized in Table 1 and discussed below.

The EII scoring is based on eight categories, scoring between 0 and 100: very bad (0-12), bad (13-25), poor (26-37), marginal (38-50), fair (51-62), good (63-75), very good (76-87), and excellent (88-100). EII scores can be calculated at site, reach and watershed scales. The overall watershed scores are determined by grouping the site-specific scores for each subcomponent at each site together and calculating an average subcomponent score for the watershed. For example, If a watershed has three monitoring sites, then the three sub-component scores for water quality would be averaged together. This process is repeated for aquatic life, non-contact recreation, contact recreation, and habitat quality. Since sediment quality is only evaluated at the watershed's mouth, no averaging is required. These averaged subcomponents scores and the sediment quality score are then averaged together to determine the overall EII watershed score. The site-specific score is determined by averaging all six subcomponent scores together at a site.

After field testing and reviewing the EII scoring procedures in November of 1994 and June of 1995, refinements were made to the protocols in order to adapt the EII for the master plan process. These changes included reclassifying some parameters as non-scoring, and modifying the calculation method. Internal review of field tests concluded that EII met the project goals and objectives, and was a useful tool for providing a baseline assessment of the environmental integrity of Austin's watersheds. The implementation of the EII occurred in 1998 with the start of Phase I of the Watershed Protection Department's masterplan process; Phase I encompassed the technical assessment of eighteen watersheds and development of solutions for those watersheds. This report describes the EII methodology, similar indices used in a regulatory setting, and presents data from field tests. As an appendix, results from the 1996 survey of the 18 Phase I Masterplan watersheds are included. Initially, the EII protocols were envisioned for use in the masterplanning process for the urban creeks in FY 1996-97 and the non-urban creeks in FY 97-98. However, drought conditions in Central Texas and changes to the EII made as the masterplanning process unfolded necessitated completion of the phase one fieldwork in the fall of 1996. As a result, representative aquatic biological conditions did not exist at many of the monitoring sites because of the lack of sufficient baseflow. The following table summarizes each of the subindices that are currently being used in the EII.

Table 1: Summary of EII Components

Contact Recreation Swimming/Wading	Non-Contact Recreation/Aesthetics	Water Quality	Sediment Quality	& Channel Stability	Aquatic Life Support
Fecal Coliform	Surface Appearance	Fecal Coliform	Metals	Channel Alteration	Macroinvertebrate
	Litter	Total Suspended Solids	PAHs	Sediment Deposition	Community Structure
	Odor	Total Dissolved Solids	Organochlorides,	Embeddedness	Diatom Community Structure
	Clarity	Nitrate-Nitrogen	Pesticides, & PCBs	Channel Flow Status	Algae Percent Cover
	Percent Algae Cover	Orthophosphorus	*Grain Size*	Condition of Banks	Chlorophyll a
	Greenbelt/Buffer	Ammonia-Nitrogen	*Acid Volatile Sulfides*	Bank Vegetation Protection	Fish (presence/absence)
	Trail/Access		*Total Hardness*	Disruptive Pressure	*Instream Cover*
				Riparian Zone Width	*Channel Flow Status*
				Lateral Stability	*Embeddedness*
				Vertical Stability	*Frequency of Riffles*
				Bed Material Size Distribution	*Anaerobic Conditions*
				Channel Stability	*Riparian Zone Width*
				Landform Slope	*Riparian Vegetation Type*
				Mass Wasting	
				Debris Jam Potential	
				Entrenchment Ratio	
				Bank Rock Content	
				Cutting & Deposition	
				Scouring	
				Rock Angularity	
				Brightness (Clean Rock)	
				Attached Aquatic Vegetation	
				Obstructions	
				Consolidation	
				Bank Vegetation Protection	
				Percent Stable Material	

Note: Italicized Parameters are Not Used in Scoring EII

1.6 Compilation of Combined Indices

The indices are used to calculate one score at each site by averaging the component scores for each subindex. While this method appears to give an unbalanced weight to recreation related scores (40% of the score is combined contact and non-contact recreation), these classifications are fundamentally related to the potential human uses of the stream for swimming/wading (which is evaluated on a public health basis), and aesthetic character (which is evaluated on a visual impact basis). Both of these uses are significant and are addressed differently in development of remedies and protections. Therefore, while it appears that recreation is a major component, the uses protected under these categories warrant the weighting.

For evaluation of areas for Masterplan prioritization, the fundamental units are reaches, which are defined as the channel length midpoint to midpoint between EII stations (endpoints). These designations may change based on morphological studies contributing to the erosion control assessments also under development by a consultant to the Watershed Protection. Individual components for each site can also be combined to a global rating for each watershed. Current plans for these combinations are straight averages of individual site subcomponents. Once data have been analyzed, considerations for weighting factors based on drainage area or reach length may be evaluated.

2.0 ENVIRONMENTAL INTEGRITY INDEX COMPONENT METHODOLOGIES

Components of the individual subindices were determined based on literature review, discussion among the various subcommittees in the service improvement project, and cost-effectiveness of the index as a whole. An attempt was made to restrict analytical parameters to those that could be determined without the assistance of a contract laboratory. However, with some parameters such as chlorophyll-α and sediment pollutants, the inclusion of the data in the index appeared to outweigh the cost of analytical services. Budgets of time and materials were developed from the list of parameters in order to determine the ability of the Environmental Resource Management Division to successfully complete the index for a large group of watersheds. Following the development of the EII, these parameters were reorganized during meetings of ERM management in order to organize an index on the basis of designated uses. Additional parameters were added at this time to better measure the suitability of a waterbody for each use category. Other parameters that required non-standardized, time-consuming procedures or redundant measurements were dropped.

Parameters were restructured again during meetings of the Watershed Protection Masterplan Coordinating Committee in order for the index to fit the organization of the masterplan and represent the three missions of the Watershed Protection Department (water quality, erosion control, and flood protection). Discussions of the resulting index, background support, procedures for scoring, and results from 1994 and 1995 pilot watershed investigations are included in the following sections. Raw data and calculated subcomponents for the pilot study are included in Appendix D. After collection of data for the 18 phase I Masterplan watersheds, the index was again modified to a limited degree in 1996 based on practical limitations identified during field work. Sites selected for this survey are documented in Appendix B. These additional modifications affected the scoring in conditions of no flow, the minimum number of organisms necessary to calculate biological indices, and the addition of Stream Stability parameters. Data for the 1996 survey is provided in Appendix E. A flowchart for calculation of the indices is provided in Appendix F.

2.1 Contact Recreation

Contact or “primary” recreation suitability of water bodies can be determined through the use of a variety of bacteriological indicators as well as specific pathogen counts. Due to the time, difficulty, cost, and variability in specific pathogen analyses, contact recreation suitability is typically measured by the concentration of a bacteriological indicator organism group. The most widely used indicator of sanitary conditions is the analyses for the fecal coliform group density found in Standard Methods for Examination of Water and Wastewater (Method 9221E). The result of the test is a concentration of the fecal coliform bacteria group in terms of Most Probable Number (MPN) of colonies per 100 ml of sample. The MPN, rather than an actual enumeration, is an index of the number of coliform bacteria that, more than any other, would give the results shown by the laboratory examination. The fecal group of coliforms is isolated through the use of an incubation temperature simulating the environment present in the gut and feces of warm-blooded animals. Through a review of current literature and regulatory applications, fecal coliform measurement was compared to the currently available bacterial, protozoan, and viral indicator organisms and pathogens commonly used in surface waters as indicators of contact recreation suitability. In addition, the ranges of fecal coliform concentrations representing various levels of suitability were also investigated in this review.

2.1.1 Background

A great deal of research has been accumulated concerning the detection and occurrence of indicator organisms and pathogens (Baker 1996, Baker 1995, Baker 1994, Emde 1992). Recent research focuses on the development of rapid methods of laboratory analysis and indicator organisms which may allow more definition as to the source of pollution impairing recreational use (Jagals, 1995). Research in the improvement and simplification of the coliform test method includes formulation of selective media, membrane filtration techniques, Most Probable Number methods and statistics, presence/absence techniques, and rapid enzymatic detection systems (Emde, 1992, Baker 1995). Research in the detection of specific pathogens has included improved recovery methods and viability techniques, gene or nucleic acid probes, virus concentration, chromogenic substrates, and immunoassay techniques. These methods have been found to be specific and highly sensitive; however, they are also costly, require specialized equipment, necessitate highly trained personnel, and will require validation against recognized standard methods to gain regulatory approval for routine use.

Although an imperfect indicator, fecal coliform measurements remain the most commonly applied method for determining pathogenic contamination of waterbodies. Alternatives under investigation which appear to be most promising as species specific indicators of human fecal pollution are *Bacteriodes*, several strains of *Aeromonas*, *Legionella pneumonphila*, and several of the bacteriophage viruses (Baker 1996). At the present time, none of these potential tests has been developed to the point that it can be consistently and economically used in a small routine water analysis laboratory or field kit setting as required for the EII. In addition, the overwhelming use of the fecal coliform tests in current regulatory settings makes it preferable for background and comparison purposes with data from state or national sources. Both the World Health Organization (WHO), and Texas Natural Resource Conservation Commission (TNRCC) currently use the fecal coliform test to determine suitability of surface waters for contact recreation use (Salvato 1982, TNRCC 1996). The U.S. Environmental Protection Agency currently prefers the *E. coli* and enterococci tests although it has used fecal coliform in past Water Quality Criteria (USEPA 1986).
Most of the references that addressed regulatory classification of waterbodies recommend multiple sampling due to the variability of the test and the transient spikes typically measured following storm events. Standard Methods recommends that investigators "consider the results of the examination of a single sample from a given source as inadequate…When possible, base evaluation of water quality on the examination of a series of samples collected over a known and protracted period of time"(WEF/APHA/AWWA 1995). In addition both the EEC and WHO guideline criteria for recreational suitability are based on 80-95 percentiles (respectively) of the parameters measured (Marino, 1995).

A number of variability factors in the coliform test indicate that multiple samples should be used in making regulatory decisions. One factor is the die-off rate of fecal coliform in sample containers. With a required holding time limit of only six hours, it is evident that timing of sampling and analysis effects the results obtained. In addition, it has been observed that the presence of suspended sediment in sample containers will also artificially reduce the die-off rate of coliforms, yielding variable results. Because of the variability noted in the test, several researchers have suggested a companion verification indicator also be used such as heterotrophic bacteria counts (Baker, 1996). Fecal streptococci has also been suggested as a companion indicator to isolate to origin of fecal contamination from coliform to streptococci ratios; however, recent research indicates that the ratio itself is generally variable, limiting its usefulness as an indicator of contamination sources (Baker, 1996).

The Texas Water Quality Standards (TWQS-30 TAC 307) employs a 400 colonies per 100 ml standard as an appropriate contact recreation standard for single grabs when multiple samples are not available. In general, classification systems presuppose multiple samples taken over a period of time. An example is the 30-day geometric mean limit of 200 colonies /100 ml employed by the TWQS. The Canadian Water Quality Guidelines and their updates also use this level, which (from epidemiological data) corresponds to a 0.012-1.5% chance of contracting gastrointestinal illness (Dutka, 1993). Also, recommendations from a WHO study include the following recreational classification for multiple samples: MPN >2,000/100mL (heavily polluted and objectionable), MPN 1,000-2,000/100mL (distinct pollution and suspect), MPN 200-1,000/mL (indistinct pollution), MPN 50-200/100mL (slight pollution), and MPN<50 (highly satisfactory) (Cabelli, 1976). Both the TWQS and WHO classifications are used in the selected EII procedure for scoring. During the development of the EII, Fecal Coliform samples were taken on a single sample basis due to time and staff constraints. However, since 1997, monthly samples are taken from EII sites for a one year period, allowing for a multiple sample analysis approach.

2.1.2 Procedure for Scoring

The site contact recreation scores are based on fecal coliform analysis performed on water samples taken for use in the water quality subindex. Only single sample results were routinely available in the initial scoring system. When consistent multiple sample results are accumulated over time, a moving average method will be used. However, the monitoring anticipated for the EII does not include such frequent visitations to the sampling sites such that a 30-day moving average approach would be possible. When multiple site scores are available, the creek score is calculated as an average of all the sites in the watershed. Incorporating the recommendations from the WHO study and the TNRCC criteria, the proposed ranges are (MPN> 2,000/100 ml) bad, (MPN 1,000-2,000/mL) poor, (MPN 400-1,000/ 100 ml) good, and (MPN <400/100 ml) excellent (Figure 1). Through linear interpolation using eight equally spaced ranges these concentrations correspond to the following EII subcomponent scores: (MPN 6,001 to >10,000/100 ml) very bad, (MPN 6,000 –2001/100ml) bad, (MPN 1,501-2,000/100 ml) poor, (MPN 1,001-1,500/100 ml) marginal, (MPN 701-1000/100ml) good, (MPN 401-7,00/ 100 ml) very good, and (MPN <400/100 ml) excellent. Although the upper endpoint of the fecal coliform test depends upon dilution values necessary to achieve a readable range, the EII score of zero (0) was used for any value over 10,000 MPN/100 ml.

2.1.3 Results from Pilot Watersheds

The contact recreation scores for the contact recreation subcomponent are shown in Table 2 for the 1994 and 1995 pilot watersheds. As indicated, Williamson Creek was not sampled in 1994, but was added in 1995. Also, two samples were taken at each site in 1994, whereas one sample was taken in 1995 due to timing and manpower constraints. The two data sets taken in 1994 were duplicate samples and indicative of the variability of the test rather than a longer-term average. The range of data was considerable in both surveys; however, it was slightly more widely spread in 1995. Classification of creeks ranged from excellent to fair in 1995 and excellent to good in 1994. All creek scores rated consistently from 1994 to 1995 data with the exception of East Bouldin that dropped from good in 1994 to fair in 1995.

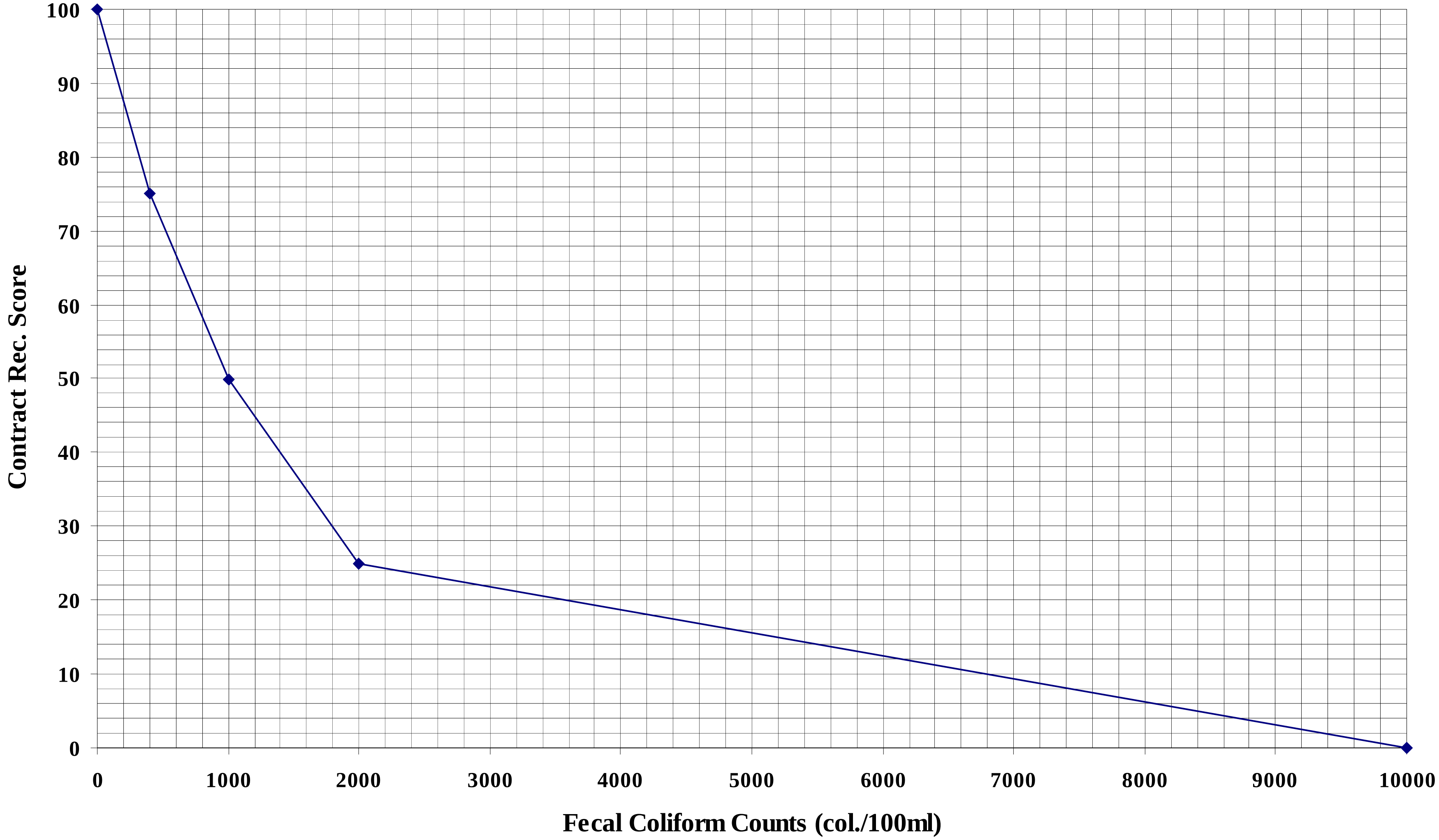
2.1.4 Pilot Watershed Interpretation

Correlating the values obtained from the pilot studies to the development characteristics of the site and watershed is critical to the evaluation of the index for application as a planning tool. First, as sub-watershed evaluator, the scores did not generally reflect the cumulative impacts of the watershed from upstream to downstream. This may be a simple matter of localized conditions overpowering cumulative impact, or it may be reflective of the variability in the fecal coliform test noted previously. It may also be reflective of bacterial die-off mechanisms localized in sub-reaches of the stream such as sediment entrainment in pools or photodegradation in unshaded reaches.

Table 2: Contact Recreation Results for Pilot Watersheds

Creeks Sampled	Contact Recreation Scores	
	Fall ‘94	Summer ‘95
Barton	96	93
East Bouldin	62	44
Fort Branch	87	90
Shoal	72	51
Williamson	.	87

Figure 1: Contact Recreation Scoring Index



Second, the creek classifications and scores are reflective of the general level of development noted in the watersheds with the exception of Fort Branch which rated excellent in both surveys, yet has a high degree of development more consistent with the low -scoring watersheds of Shoal and E. Bouldin. One potential explanation of this occurrence is that Fort Branch is the only urban creek in the area of east Austin in the pilot group. This area is typically characterized by soil substrates, which is significantly different from west Austin. This distinction may also be seen in other subcomponents such as aquatic life, physical habitat, and water quality. Compensation can be made in the aquatic life subindex through the use of an ecoregion specific reference site; however, no such normalizing factor is available for contact recreation. In addition, the amount of imported upland soil in a highly urbanized watershed tends to obscure the impact of native soil substrates. Once additional data are available for the other Master Plan target watersheds, and trends with other indices can be evaluated, this anomaly can be revisited prior to interpreting the data for watershed planning.

Finally, several high values observed in both surveys for Shoal Creek are useful as indicators of the need for more "best management practices" in the watershed. In fact, in both surveys, one sample location dictated the final classification of Shoal Creek. In 1994 all upstream samples rated excellent with the single value of 3600 MPN/100mL at the downstream site resulting in a creek classification of “good”. Similarly in 1995, a high value of >10,000MPN/100 ml at the upper mid-site moved the creek classification into the “good”, range from excellent. These spikes may be useful in pointing out the influence of practices or utilities in these watersheds that affect the variability in the quality of baseflow. However, they also may simply point out the variability of the test and reduce the confidence in the snap shot approach in identifying contact recreation suitability.

In general, the reproducibility of the contact recreation data for the pilot watersheds supports its continued use in the EII in average Creek rankings. However, the data indicate that sub-watershed use of the data has less support unless local sub-watershed or reach influences override overall watershed development levels for this subindex. Overall, as noted previously, no other indicator has been identified that can perform better for contact recreation suitability.

2.2 Non-contact Recreation and Aesthetics

The Environmental Integrity Index is based on a holistic approach to watershed protection, which includes human benefit components. Natural environments are commonly defined as predominantly composed of vegetation and other natural elements with little or no evidence of human disturbance. In addition to a healthy ecologically functioning system that is associated with the natural environment, there are other benefits that are less commonly recognized. Increasingly, physiological and psychological studies provide empirical support for both physical and mental benefits of exposure to natural healthy environments (Reference???). Specific benefits of the natural environment include stress recovery and restorative effects, accelerated recovery from illness, alleviation of mental fatigue, increased enthusiasm, job satisfaction, and enhanced self-esteem. The protection and management of Austin's streams and watersheds (including riparian zones) are excellent ways to capitalize on these benefits. In the Environmental Integrity Index, these benefits are represented by two categories, contact recreation and non-contact recreation/aesthetics. This section describes how the non-contact recreation/aesthetics subcomponent was developed.

An important characteristic of a stream corridor is the quality of the recreational opportunity it provides for the community. Non-contact recreation refers to any activities that does not require entry into the water. Many of these activities occur on the banks and within the riparian corridor. Hiking, cycling, rock climbing, and disc golf are examples of some of the popular non-contact recreational activities in Austin-area greenbelts. Few of Austin's creeks have sufficient flow to allow boating and fishing activities. Determining the aesthetic value of a stream corridor is based on the visual appeal of the physical setting to observers. Aesthetics such as water clarity, the absence of litter, or the view from a scenic bluff are important characteristics of a creek corridor and influence a person's decision to visit the creek. A subindex for non-contact recreation and aesthetics must convey the suitability and potential for recreational enjoyment of a creek.

Standardization of the assessment parameters and establishing clear, definitive descriptors for each category of conditions helps reduce variation in observer interpretation and scoring. Additionally, there is a need for field staff to be trained in standardized scoring interpretation. Photodocumentation of the established standard condition of each assessment category is useful in training for uniform scoring. Similarly, trial calibration runs and review of assessment responses are also useful.

2.2.1 Background

There are three general categories of descriptive factors that are useful in evaluating landscape aesthetics and recreational value of riverine areas: 1) physical factors; 2) biological and water quality factors; and 3) human use and interest factors (Leopold, 1969). Examples of some specific factors that could be included in each category are as follows:

Physical Factors:

- Stream width
- Stream velocity
- Stream depth
- Stream bed material (clay or silt, sand, sand and gravel, gravel, cobbles)
- Bed slope
- Erosion of banks stable (slumping, eroding large scale deposition)
- Sediment deposition in bed

Biological and Water Quality Factors:

- Water color (clear, green, brown)
- Turbidity
- Floating material (vegetation, foamy or oily substances)
- Algae (amount and type)
- River/stream fauna and flora
- Pollution evidence

Human Use and Interest Factors

- Trash and litter (metal, paper, other)
- Artificial controls [dams, etc.] (free and natural to controlled)

- Accessibility (individual or group use)
- View confinement (open or no obstructions to closed by hills, cliffs, or trees)
- Land use (wilderness, grazed, lumbering forest, to mixed recreation or urbanized)
- Level of urbanization (presence of buildings)
- Special views
- Historic features (none to many)

These factors may be useful in describing a site and assessing its potential recreational and aesthetic value. A scale can be established along a continuum of conditions between two extremes for ranking the stream characteristics of a site. Various combinations of factors can also be selected to describe a particular aspect of a single stream characteristic. For example, scenic views can be ranked by combining several factors describing the views such as presence or absence of vistas, view confinements, and utilities.

Flow Related Recreation

The character of the stream and the floodplain often determines recreation opportunities in riparian environments. The National Park Service (NPS) recognizes the importance of instream flow criterion for determining and assessing the condition of many recreation resources of stream environments (Whittaker et. al, 1993). Important elements common to a quality recreation experience of a stream corridor are often cited as scenery, a natural or natural appearing environment, fish, and wildlife. Other important elements may include the opportunity for solitude, quality fishing, swimming, boating, or hiking. Instream flow affects almost all of these elements either directly or indirectly. Activities such as boating, swimming, wading, or fishing are referred to as flow dependent activities. Conversely, activities that are indirectly related to flow are referred to as flow-enhanced activities. These include activities such as wildlife observation, hiking, riverside camping and general enjoyment of scenery (Whittaker, et al, 1993). The following is a summary of recreation activities that are influenced by flow and recommended for recreational evaluation by the National Park Service (Whittaker, et al, 1993);

The **boatability** of a stream is commonly determined by the amount of flow present in a stream. Boatability is dependent on having sufficient flow to navigate a boat up or down a stream without hitting obstacles (i.e. scraping bottom, etc.). In the NPS method, boatability is rated on a five-point scale along a continuum of conditions from optimum floatability to unboatable based on the relative amount of flow present.

The **swimmability** of a stream refers to conditions that provide high quality swimming or wading opportunities. Such conditions include water depth, velocity, appearance, and associated channel features. Instream flow affects all of these conditions. Without sufficient flows, water depth will be too low for good wading, swimming, or diving. Conversely, at high flows water velocities can become too swift for these activities. Additionally, sun bathing rocks and beaches may be covered by the water and water visibility diminished, resulting in undesirable conditions. By considering both depth and velocity of a stream, a range of conditions describing the quality of swimming activities corresponding to various combinations of depths and velocities can be developed.

The **fishability** of a stream is related to sufficient instream flows to support a healthy fish population. A good fishing experience is often dependent on having a good place to fish from, water clarity, and varying habitat combinations of pools and riffles. All of these conditions may be affected by flow. Additionally, fish activity levels are also affected by flow. At low flows, fish are not active. Likewise, fishing quality declines with increased water velocities associated with higher flows. Medium flows are generally associated with good fishing conditions. However, this assumption depends on the type of fishing under consideration. Fishability evaluations need to identify the type of fishing the stream is being assessed.

Aesthetics refers to both visual and auditory qualities of channel and riparian features. The perceived aesthetic quality of a stream environment is important in determining the recreation value of an area for both flow-dependent activities and flow-enhanced activities. Aesthetic appeal of different stream flows may vary depending on the experience of the user (hikers and anglers may consider lower flows more aesthetically pleasing and acceptable than white water boaters). However, it is clear that people have an aesthetic preference for water as opposed to a dry streambed. Negative aesthetic appeal is associated with very low or dry flow conditions. Low flow conditions include stagnant pools, decreased water quality, stranded substrate features, algae, litter, and loss of stream vitality. Likewise, negative aesthetic appeal is associated with extremely high flow conditions. Negatively associated high flow conditions include loss of riffle and pool contrast, disappearance of islands, bar, and beaches, increased turbidity and decreased water quality. In general, aesthetic quality increases with flow to a point and then begins to decline.

2.2.2 Method Development

Development of the non-contact recreation/aesthetics subcomponent included consideration of many factors related to the flow and appearance of the stream corridor. Less critical are swimmability, fishability and boatability, which are restricted to only the larger bodies of water in the area. For Austin-area creeks, flow volume and water appearance are the probable dominant factors that users consider when selecting recreational sites and activities. Also, these factors may be readily surveyed on a uniform basis in creeks in diverse geologic settings. The subcomponent should be adaptable to assess the non-contact recreation suitability in creeks in the limestone-dominated landscapes west of Austin, as well as the clay-soil landscapes east of Austin. This is best accomplished by considering the appearance of the water in the creek, the flow characteristics, and the amount of public land adjacent to the creek. Although there are additional criteria that affect an individual's selection of a site and activity for recreation, they are difficult to survey and measure objectively.

Public access is an important factor to consider when assessing the recreational opportunities for a creek. Trails provide access to hikers, bicyclists, or fishermen. Greenbelt areas are attractive for many types of recreation such as playing disc golf, having a family picnic, or attending a jazz concert. The available land for access and conducting recreational activities is a major determinant when choosing a creek-side location for having fun. For this reason, the non-contact recreation/aesthetic assessment initially included an estimate of available trail length and the greenbelt/buffer length.

2.2.2.1 Existing Methods

A literature search conducted to find existing approaches for assessment of non-contact recreation/aesthetic value identified stream assessment procedures developed by the Texas Water Commission, the Tennessee Valley Authority, the Izaak Walton League of America, and the EPA. The EPA Rapid Bioassessment Protocol (RBP) for stream habitat quality assessment proves to be the most helpful in terms of providing a technique for visual survey and ranking of parameters related to non-contact recreation and aesthetics. This visual-based technique results in a site score that is based on the integrity of the riparian corridor and its suitability for recreation. Site scores may be combined to determine an overall stream score. The habitat quality of the corridor, the appearance of the water, and the flow volume has the greatest visual impact and potentially the greatest psychological influence on recreational users. Therefore, visual assessment of these characteristics is desirable for gauging potential use of the stream corridor.

Survey methods and professional judgment seem to be the most useful tools in evaluating stream environments for their aesthetic quality and recreation potential. Surveys are usually designed to solicit information from the recreationist. The recreationists/users are experts about factors such as their preferred experience, how they like to fish, swim, hike etc. Surveys or interviews with focus groups can provide useful information particularly when the group is composed of experienced users of the resource. Often, experienced users are keen observers of conditions favorable to both experienced and inexperienced users. However, responses of focus groups should be analyzed to determine how well they represent both groups of users (Whittaker et. al, 1993).

For the EII, field surveys are conducted by City of Austin staff. Participating staff use a standardized survey form for assessing 30 meters upstream and 100 meters downstream of each creek site and assigning a non-contact recreation/aesthetic score.

2.2.2.2 Description of Parameters Used in the Non-Contact Recreation/Aesthetic Subcomponent

The non-contact recreation/aesthetic assessment is designed to determine the desirability of a creek corridor for uses such as hiking, biking, nature observation, aesthetic enjoyment, etc. Opportunities for these uses are based on a visual/sensory assessment and physical measurements at selected creek sites. After the observer completes the survey form, the resulting parameter scores are calculated and averaged to arrive at a final composite non-contact recreational/aesthetic score for each creek. The following is a brief description of the categories selected to represent non-contact/aesthetic uses.

2.2.2.3 Visual/Sensory Assessment Parameters

- Clarity - Clarity is a visual assessment of turbidity.
- Litter - Litter scoring is a visual survey of the litter conditions at each site.
- Flow Volume - Flow volume visually describes the amount of flow occurring at each site.
- Odor - Odor is a sensory assessment of objectionable odors existing at each site.
- Percent Algae Cover - Percent algae cover is a visual assessment of algae occurring on or below the water’s surface.
- Surface Appearance - Surface appearance is a visual assessment of the percent of organic floatables, plants, woody debris, etc. (excluding algae).

Percent algae cover, an indicator initially included in the water quality subcomponent, has been added to the non-contact recreation/aesthetic subcomponent. Algal growth on the substrate or in a creek pool is unpleasant in appearance and discourages passive and active recreational activities. Hikers are less likely to rest next to a pool containing noticeable amounts of algae. If there is heavy algae cover; there may be an odor due to decay of the plants. Due to the fact that much of the population associates algal growth with poor water quality, its presence and potential anoxic conditions will have a negative psychological impact on recreational visitors.

Nonscoring Physically Measured Parameters

Greenbelt/Buffer - The creek greenbelt/buffer score is a physical measurement of public green space along a water corridor. This measurement is an indicator of aesthetic value, wildlife habitat value, and potential public access.

The greenbelt buffer score is calculated by measuring the length of the stream bank occurring within an official City park, greenbelt, preserve, or other public green space or access point, and dividing this number by the total stream bank length then multiplying the number by 100 to yield a percentage. This score is calculated; however it is not used in the calculation of the index. The stream bank length measurements are obtained with a map wheel from a published city map, or from Geographical Information System (GIS) land use coverage, or information obtained from the Parks and Recreation Department.

Note: In instances where significant access is provided by other public institutions besides the City, such as the University of Texas, then the stream lengths of these areas are added into the total official access areas and a special note is included to document this.

Trail/Access - Trail/access score is a physical measurement of the ratio of official trail lengths occurring along a stream to the stream length. This measurement is representative of the degree of official public access to the creek for jogging, walking, etc.

The trail/access score is calculated by taking the hike/bike trail distances for watershed and dividing this number by the total stream length then multiplying the number by 100 to give a percent score. Total stream length is determined by measuring the length of the stream from a published City Map using a map wheel or it is obtained from land use data. Only City of Austin PARD trails are included. The score is recorded, but not used in the calculation of the index.

N*ote: Trail loops and trails that cover both banks could skew this measurement, but presently, official trails cover one bank and loops are minimal.*

2.2.3 Procedure for Scoring

A non-contact recreation/aesthetic score is based on a visual/sensory assessment. Scores are recorded on the non-contact recreational use field assessment form. (Figure 2). The visual/sensory assessment is conducted through field observation. This assessment includes the creek and the adjacent stream banks. The area surveyed encompasses 30 meters upstream of each site, 100 meters downstream, and the visible area of each stream bank. Field assessment forms include a description of the conditions associated with four categories, Excellent, Good, Poor, and Bad for six parameters to serve as a scoring reference. Parameters are ranked on a 20-point scale that represents the overall conditions of stream bank at that site. Field assessment forms include a description of the conditions associated with the four categories, excellent, good, poor, and bad for six parameters to serve as a scoring reference. Parameters are ranked along a 20-point scale, where 20 to 16 is excellent and 5 to 1 is bad condition (see assessment form for a description of each category). All parameter scores are summed for each site to determine the site total score which is then divided by 120 (the maximum possible score for the six parameters) and then multiplied by 100 to determine a percent score for each site. The site scores are then averaged to give a final creek score.

Notes and photographs are used to document the conditions of the creek and the overall appearance of the creek at the time of the survey. Photodocumentation of the field assessment area facilitates uniformity in the scoring procedure. This documentation allows the observers to determine the consistency of their scoring, the reproducibility of the results and variation of scoring between observers.

Figure 2: Non-Contact Recreational Use Field Assessment Form

DATE________________ TIME________________ OBSERVER______________

SITE_____________________________________

Indicator	Excellent (20-16)	Good (15-11)	Fair (10-6)	Poor (5-1)	Score
Clarity	Clear to slightly cloudy, visability mostly good	Slightly cloudy to cloudy, visability somewhat impaired	Cloudy to very cloudy, impaired visability	Very cloudy/murky, can't see below surface	Score:______
Litter	Very little litter present in the creek and on the banks; no glass	Some litter present in the creeks and on the banks; mostly small items (paper, wrappers); no glass	Litter present in the creeks and on the banks; larger items (cups, containers, cans); a few pieces of glass	Large volume of litter in the creeks and on the banks; dumping; glass and/or sharp metal objects readily apparent	Score:______
Flow volume	Steady, running flow; water reaches both channel banks	Moderately running; evidence of diminished flow; some areas of the creek channel are dry.	Slight, trickling flow, most of the creek bed is dry	Dry creek bed, Isolated stagnant pools	Score:______
Odor	No odor to very faint offensive odor (e.g. fishy, sulphurous, petroleum, dead animal)	Slight offensive odor (e.g. fishy, sulphurous, petroleum, dead animal)	Noticeable offensive odor (e.g. fishy, sulphurous, petroleum, dead animal)	Strong offensive odor (e.g. fishy, sulphurous, petroleum, dead animal)	Score:______
Percent Algae Cover	Surface less than 10% covered by algae	Surface 10-20% covered with algae	Surface 20-30% covered by algae	Surface more than 30% covered with algae	Score:______
Surface appearance	Surface less than 10% covered by organic floatables, plants, woody debris, oil or foam, etc...	Surface 10-20% covered by organic floatables, algae, plants, woody debris, oil or foam, etc...	Surface 20-30% covered by organic floatables, algae, plants, woody debris, oil or foam, etc...	Surface more than 30% covered with organic floatables, algae, plant woody debris, oil or foam, etc...	Score:______

* Fish Presence / Absence (Circle One)

Non-Scoring Parameters

• Greenbelt/Buffer and Trail Access Rating to be determined from City of Aus

Greenbelt/ Buffer Rating: ________ Trail Access Rating:__________

Total: __________

Notes: ____

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Fish Presence / Absence: (Circle One)

Total Site Score: ______

Percentage Site Score: ______

The non-contact recreation method is an attempt to establish protocols and parameters that will be useful in evaluating and monitoring conditions directly affecting the recreational and aesthetic qualities of a stream corridor. At present, this procedure is still in the development stage. As the procedure is tested, opportunities for refinement will be noted and additional techniques incorporated into the assessment method.

2.2.4 Results from Pilot Watersheds

Two pilot assessments have been conducted in Austin-area watersheds. In November and December 1994, an initial pilot assessment was conducted in the Barton Creek, East Bouldin, Fort Branch, and Shoal Creek watersheds. In June and July 1995, an assessment was conducted in the Barton Creek, East Bouldin, Fort Branch, Shoal Creek, and Williamson Creek watersheds. Results from the pilot assessments are presented in Table 3. The table includes scores assigned by the observers and scores derived for the greenbelt/buffer measurement and the trail/access measurement.

Table 3: Non-Contact Recreation Results for Pilot Watersheds 1995

Creek	Visual Combined	Visual Combined
Barton Creek	89 75	93 78
East Bouldin	71 58	64 51
Fort Branch	78 59	64 51
Shoal Creek	70 63	59 57
Williamson Creek	N/A N/A	75 61

This comparison reveals that the greenbelt and trail scores affect the ranking of the creeks. Shoal Creek ranks lower than East Bouldin and Fort Branch in the overall score but has higher final scores due to the higher score for greenbelts and trails. This skew is acknowledged and one of the reasons these parameters were moved to nonscoring information.

It is interesting to note that none of the creeks scored above 78 percent. Barton Creek, generally considered the most desirable creek for non-contact recreation by Austinites, scored the highest in both assessments. Fort Branch, East Bouldin Creek, Shoal Creek, and Williamson Creek received consistent mid-range scores. The 1994 pilot assessment resulted in slightly higher scores for these creeks, but with the same general pattern.

Although not selected for the final index, the greenbelt/buffer scores are included in this discussion because they indicate some important information concerning the pilot watersheds. Greenbelt/buffer scores measured in 1994 had not changed at the time of the 1995 assessment. Greenbelt/buffer scores ranged from 100, indicating a continuous greenbelt adjacent to a site, to 0, indicating no greenbelt associated with a site. The Barton Creek greenbelt/buffer score of 100 was for the site above Barton Springs Pool. However, only 16 percent of the 85-mile length of the creek, the Barton Creek Greenbelt, is on publicly owned land. Two of the upstream sites have a greenbelt/buffer score of 0. Shoal Creek has a high percentage of greenbelt/buffer space. Williamson Creek has a dozen segments of greenbelt but these are not contiguous. East Bouldin Creek has several segments of greenbelt, some of which are inaccessible. The only greenbelt area found adjacent to Ft. Branch is Springdale Park.

The relatively low scores for greenbelt/buffer and trails when using the physically measured parameters in scoring resulted in lower than expected overall scores for each of the pilot watersheds. Many of the sites had excellent water clarity and odor in the 1994 assessment. In 1995, there were more frequent good ratings for clarity and odor. Flow volume was rated as excellent to good for 1994. Heavily urbanized watersheds, such as Shoal Creek, had greater variability in flow volume between sites.

2.2.5 Pilot Watershed Interpretation

Barton Creek received the highest scores for non-contact recreation/aesthetics during two pilot watershed assessments. The probable reason was the high flow volume conditions during the late fall of 1994 and the late spring of 1995. The non-contact recreation/aesthetic score favors high flow conditions because it results in excellent conditions for most parameters. During low flow, stagnant pools and floating debris results in lower site scores. Variability of flow volume between sites and between creeks is often related to urbanization within the watershed including detention structures, stormdrain diversions, infiltration modification, and excavations. Barton Creek had consistent flow volume between sites and is notably the least urbanized of the pilot watersheds. The flow volume present in the creek at the time of measurement is largely due to groundwater discharge originating as rainwater infiltration in the large rural areas of the watershed. In heavily urbanized watersheds, such as Shoal Creek, there are few open areas for rainwater infiltration. As a result, rainwater quickly enters the stream channel as surface water runoff. Flow occurs in these creeks primarily under storm conditions. Some flow in the channel may occur from springs, leaks from water or wastewater lines, and runoff of lawn irrigation water. These flow conditions are highly variable between sites and between watersheds. It is expected that the urbanized watersheds are going to receive lower scores due to this variability and due to the effects of low flow on other Non-Contact Recreation/Aesthetic parameters. Therefore, the degree of human disturbance in a watershed is embedded in the scoring process and is related to the flow conditions.

The amount of available greenbelt and trails was noted in Barton Creek non-scoring physical measurements. Although Barton Creek ratings for these parameters were lower the rates for Shoal Creek, they were noticeably higher the ratings for East Bouldin Creek, Fort Branch, and Williamson Creek. At present, the assessment method does not account for the quality of the greenbelt or trails. Desirable characteristics of the quality of a greenbelt or trail were also thought to be too subjective for inclusion in the method. However, it is probable that many Austin residents would agree that the quality of Barton Creek greenbelt and trails exceed those of most other watersheds.

2.3 Water Quality Index (WQI)

Compilation of water chemistry parameters into a single index value is a common method of environmental indexing. With the exception of some modifications to increase the statistical rigor and utility of the water quality index, this sub-component is similar to indices compiled for current regulatory use.

2.3.1 Background

The City of Austin-Environmental Resources Management Division developed a protocol for creating an affordable water quality index (WQI) that is easy to understand, specific to a waterbody, and capable of assessing the current condition of a water resource. The framework of the City's index is based on the system devised by the national sanitation foundation (NSF) which uses conversion curves to transform water chemistry results into quality values (q-values). However, the City developed a protocol, the median method, which uses historical water quality data to create region specific water quality value curves for six major water chemistry parameters. This ecoregion approach in water quality indexing should provide a more representative evaluation of the water chemistry data, because natural differences between waterbody systems and physiographic differences in water chemistry are minimized. In addition, this water quality indexing protocol effectively communicates the water chemistry information in a single region specific water quality index score.

2.3.2 Procedure for Scoring Water Quality

2.3.2.1 Water Quality Index Parameters

By completing a literature review of water quality indexing methods and using best professional judgement, the parameters selected for the water quality index are nutrients, bacteria, and total suspended and dissolved solids. This decision is based on the fact that these parameters are important constituents contributing to nonpoint source pollution, they are affordable to analyze, and provide reliable indicators of the effects of urban runoff. The parameters and the methods of analysis are provided in Table 4.

Table 4: Water Quality Subcomponent Parameters and Methods

Parameters	Analytical Method
Nitrate – Nitrogen (mg/L) NO_3-N	HACH DR2000 - 8192 or 8171
Fecal Coliform (col./100ml)	Standard Methods 9221E
Total Suspended Solids (mg/L) - TSS	Standard Methods 2540D
Total Dissolved Solids (mg/L) - TDS	Corning M90
Orthophosphate (mg/L) - Ortho-P	HACH DR2000 - 8048
Ammonia – Nitrogen (mg/L) - NH_3-N	HACH DR2000 - 8155

2.3.2.2 Sampling and Analysis Protocols

Before the water quality index score was determined, median water chemistry values for the six parameters were calculated. Since most water chemistry data are variable and have asymmetric distributions due to extreme values or outliers, the median was considered to be a representative value. Except for fecal coliform, all the water chemistry values reported were median values obtained by analyzing three aliquots from each site. The sampling protocol was that baseflow conditions must exist at all sites, with no measurable rainfall within three days of the sample collection. Two one liter sample bottles were collected and split into different aliquots for analysis of the following parameters; total suspended solids, nitrate-nitrogen, ammonia-nitrogen, orthophosphorus, and fecal coliform analysis. Three 500-ml aliquots were used for TSS analysis: nutrient concentrations were determined from analyzing three 25-ml aliquots. The median concentration from the three aliquots was used to determine the q-value for each nutrient. The fecal coliform q-value was determined by using the optimal culture from the two different dilution schemes: 100 ml, and 10 ml. The optimal culture is the one that has between 20 - 80 colonies (Standard Methods for the Examination of Water and Wastewater, 1989). The total dissolved concentration was measured in the lab with a Corning M90 meter. The median of the three measurements was reported. Quality assurance and control is monitored using a low and high range standard for nutrient analysis, and all parameter analyzed will have split samples for 10 percent of the sample set. This methodology was used for all results presented in this report.

After evaluation of '94, '95 and '96 analysis results, (see Section 3.3.5), the sampling methodology for the Water Quality subindex was changed to coordinate with the Water

Watchdog Citizen monitoring program, allowing for monthly sampling and providing a more robust dataset for representative Water Quality values in the EII. Individual grab samples on a monthly basis are analyzed as described above, providing up to 12 samples per site per year, which replaces the necessity to perform three splits (separate aliquots) at one sampling event in the year. The median of individual monthly data points are then used for assigning q-values as described below.

2.3.2.3 Assigning Quality Values (Q-Values)

After completing the water analysis, the median result for each parameter is converted into a quality value (a number between 0 and 100) using a q-value curve (see Appendix C). Each parameter has a q-value curve that is generated following the median method protocol, which is discussed in section 2.3.3 of this text. The resulting q-value for each parameter is then weighted by the following percentages to produce a WQI score between 0 and 100:

Nitrate-Nitrogen	20%
Fecal Coliform	20%
Total Dissolved Solids	20%
Total Suspended Solids	20%
Orthophosphate	10%
Ammonia-Nitrogen	10%

The weighting factors vary for each parameter to reflect the variability and importance of that parameter in the eutrophication process that commonly degrades Central Texas streams. Consequently, concentrations of nitrate-nitrogen, fecal coliform, total suspended solids and total dissolved solids, which exhibit a high degree of variability in baseflow, are weighted at 20 percent. These four constituents affect percent algae cover, water clarity, sedimentation rates, and the potential for the transport of pathogens to humans. In contrast, historical water quality data indicates that orthophosphate and ammonia-nitrogen concentrations occur at low levels and may be less important as limiting nutrients of primary productivity in Central Texas streams than nitrate-nitrogen. Both are taken out of solution at rapid rates:

orthophosphate is readily absorbed onto alkaline soil particles, while ammonia is quickly converted to nitrite or nitrate by oxidation. Therefore, ammonia-nitrogen and orthophosphate are weighted at 10 percent.

2.3.2.4 Calculating the Water Quality Index Score

The site WQI is determined by multiplying the q-value by the assigned weighting factor for every parameter. The resulting scores are added together to obtain the WQI score for a site. The WQI score is a number between 0 and 100 which is assigned the following descriptive water quality rating:

100 – 76	**Excellent**
75 - 51	**Good**
50 - 26	**Poor**
25 - 0	**Bad**

To determine the total watershed WQI score, the average of the site WQIs within the watershed of interest is calculated. The same rating system used in the site WQI is used for watershed WQI in which the ratings are subdivided into 8 quality categories: very bad (0-12), bad (13-25), poor (26-37), marginal (38-50), fair (51-62), good (63-75), very good (76-87), and excellent (88-100), for use in the 1996 assessment and visual presentations.

2.3.3 The Median Method for Developing Q-Value Curves

The City of Austin Watershed Protection staff developed the median method for the purpose of using historical water chemistry data to generate regional water q-value curves. These curves are used to convert water chemistry values into a quality value (or q-value). Each parameter has a q-value curve that is constructed as follows: Sampling sites in each watershed with three or more data points are included in the historical database used for the development of the q-value curves. The development of the q-value curve is a three step process: first, the site median, maximum, and minimum values are calculated for each individual site. Second, the individual site values are grouped together by watershed, then median values are calculated for the median, maximum, and minimum values (watershed medians). Finally, the watershed values are grouped to obtain the overall regional medians of the medians, medians of maximums, and medians of minimums. These regional median values for each parameter and the highest value recorded are then used to produce q-value curves by associating these median values with a q-value. The City of Austin created water quality value curves by using water chemistry from watersheds in the Central Texas Plateau ecoregion between 1990 and 1994. Statistics for creation of water quality curves are provided in Table 5. The assignment of q-values for the statistics described above is shown in Table 6. If the reported median of all minimums is equal to or less than the detection limit, this value is dropped from the q-curve. This is the case for nitrate-nitrogen.

2.3.3.1 ANOVA for Watersheds in Different Ecoregions

Austin area watersheds extend over two ecoregions; the Blackland Prairie, and Central Texas Plateau. In development of this index for use in the City of Austin some concern was expressed by staff that watersheds in the Blackland Prairie ecoregion would be scored unfairly in comparison to watersheds in the CentralTexas Plateau ecoregion. If there were statistical differences between the water chemistry parameters, another set of q-value curves would need to be generated to make a fair comparison.

Table 5: Statistics for Development of Q-Values for Water Quality

	Total Dissolved Solids	Nitrate-Nitrogen	Total Suspended Solids	Ammonia-Nitrogen	Ortho-P	Fecal Coliform	Q-Value
Detection Limit or Zero	0	0.1	0.5	0.01	0.01	1	100
Median of all Minimums	185	.	0.6	0.02	0.02	220	75
Median of all Medians	286	0.35	2.5	0.06	0.03	635	50
Median of all Maximums	400	1.2	7	0.22	0.1	8400	25
Highest Maximum Value	540	4. 5	14	1.79	0.89	142000	0
(x, y)	x-Coordinates						y-Coordinate

Table 6: Assignment of Water Quality Q-Values

Q-Value	Regional Median Values
100	The detection limit of the analysis technique or zero
75	Median of all minimum values (based on medium minimum values for each watershed)
50	Regional Median (based on overall median value each watershed)
25	Median of maximum values (based on medium maximum values for each watershed)
0	The highest maximum value reported

It is suspected that streams in the Blackland Prairie ecoregion may have naturally higher water quality constituent concentrations than streams in the Central Texas Plateau. For example, streams in Blackland Prairie may naturally have higher total suspended solids because the streams are located in terrain that has more top-soil than the karst terrain of the Central Texas Plateau. In addition, prairie soils typically contain higher concentrations of organic matter then the karst terrain of the Central Texas Plateau. To determine if these concerns are valid, a one-way analysis of variance (ANOVA) was performed on water chemistry data collected within both ecoregions. Data published from the TNRCC Ecoregion Project was used to test for differences between these two ecoregions (TWC, 1992). Means of the water chemistry values for kjeldahl nitrogen, ammonia-nitrogen, nitrate-nitrogen, total phosphorus, orthophosphate, TDS, TSS, BOD and chlorophyll-α were analyzed. TDS was the only parameter for which a statistically significant difference between the means of the two ecoregions was present.

Values for nitrate-nitrogen in the Blackland Prairies ecoregion are highly variable; values ranged form 0.01 mg/l to 9.71 mg/l. However, the 9.71 mg/l value is an extreme value in the data set. This value was recorded from a stream which is adjacent to land where intensive agricultural farming is practiced in contrast to Central Texas Plateau ecoregion values which ranged from 0.01 mg/l to 0.76 mg/L and where 10 of 11 values were below 0.19 mg/l. If this extreme value in the Blackland Prairie data set is removed, the ranges are much more similar. The ranges of values for the Blackland Prairie would be 0.01 mg/l to 3.29 mg/l. The Blackland Prairie and Central Texas Plateau ecoregions had nitrate-nitrogen means of 1.96 mg/l and 0.116 mg/l, respectively (including the 9.71 mg/l in the data set). This seems to indicate that there may be a difference; however, because of the high variability of the Blackland Prairie data set, no statistically significant differences between the ecoregions were found. Analysis of a larger data set may indicate that a statistical difference between the water quality of the two ecoregions exists. However, the majority of the data analyzed thus far indicate that the watersheds can be compared adequately using one set of index categories.

2.3.4 Results from Pilot Watershed Study

Two pilot watershed studies were conducted in the Fall of 1994 and the Summer of 1995. The purpose was to test the methodology and consistence in scoring, and to aid in the development of the indexing system. The Water Quality results from both trial runs are provided in Table 7.

Information collected during the 1994 study resulted in some changes in sampling locations and analysis procedures in 1995. The sampling location at the Barton Springs Pool area was moved upstream of Barton Springs in 1995 to reduce the water chemistry effects of Barton Springs. Since the q-value curves are based on surface water chemistry results, using the curves to assign q-values to groundwater (or spring) chemistry results is not an equitable comparison. Williamson Creek was added to the study in 1995. Analysis procedures were changed from duplicate to triplicate analysis to reduce skewing of water chemistry results by extreme values. However, in 1995 a laboratory error occurred causing fecal coliform, total dissolved solids and total suspended solids to be only analyzed once. For the 1996 assessment, three aliquots for each parameter were analyzed and the median result used to calculate the WQI.

2.3.5 Pilot Watershed Interpretation

Overall, the best WQI scores found were for Barton Creek for both 1994 and 1995 (65 and 81 respectively). These are the highest scores for both sampling events.

Table 7: Results form Pilot Watersheds for Water Quality Index

Creek Sampled	Water Quality Scores	
	Fall '94	Summer '95
Barton	65	81
East Bouldin	48	42
Fort Branch	63	62
Shoal	52	44
Williamson	-	62

After moving the Barton mouth sampling site above the springs to minimize the water chemistry effect of the spring's water, Barton scored in the excellent range (100-76) in 1995. The next highest scores; good (75-50), were recorded in the Fort Branch, Shoal, and Williamson watersheds. Since little variability is found between the two WQIs for each year, Williamson Creek would most likely have scored Good in 1994. The excellent and good scores for Barton and Williamson are expected since they are currently non-urban watersheds with relatively lower development levels. However, Fort Branch's rating (63 and 62) is unexpected. Although the rating is close to the high-end of the Fair range, most of the urban creeks would be expected to rate Fair because of the various influences of urban development on the water quality. In 1995 Shoal Creek's score dropped to a 44, which is also the score for East Bouldin, the lowest WQI score noted in this period.

2.4 Sediment Quality Index (SQI)

2.4.1 Background

The evaluation of sediment quality is difficult, due to a lack of state or federally adopted criteria. Researchers commonly disagree on factors that influence biological effects of contaminants in sediment. As a result, agencies have developed their own method for setting guidelines or screening values to aid in interpreting sediment data. Sediment quality is also integrated into the EII, because the chemical analysis of sediment may provide a better historical representation of contamination than a water column grab sample. In addition, sediments contain higher concentrations of contaminants that may adsorb to the sediments, but slowly leech into the surface water over time. Therefore, several sediment chemistry parameters were selected, for use in the EII as indicators of habitat impairment associated with human health concerns and biological effects.

2.4.2 Procedure for Scoring Sediment Quality

2.4.2.1 Sediment Quality Index Parameters

The parameters selected for the sediment quality index are: arsenic, cadmium, copper, lead, mercury, zinc, polynucleic aromatic hydrocarbons (PAHs), chlordane, PCBs, total DDT, DDD, and DDE. These parameters were selected because published biological effects levels are available for these parameters, and they are pollutants commonly associated with non-point source pollution. Organophosphorus pesticides were considered as an additional parameter group; however, initial sample results indicated the organophosphorus pesticides concentrations are typically below detection limits. Consequently, these pesticides were dropped from the parameter group. In addition to the above parameters, grain size, acid volatile sulfides, total organic carbon, and total petroleum hydrocarbons are analyzed to aid in evaluation of the sediment chemistry results.

2.4.2.2 Sediment Sampling and Analysis Protocols

One sediment sample is collected at the mouth of each watershed for the sediment quality index (SQI). Because of laboratory analysis costs for toxic parameters and because sediment accumulates instream and is transferred downstream, this sample is used to represent the sediment component for all EII reaches.

The sediment samples collected in the field are composites of three to ten grab samples. The samples are collected using a teflon scoop. All equipment is prepared using the "Clean Method": as described by the Texas Natural Resources and Conservation Commission. Anoxic sediments are avoided. The grab samples from the multiple scoops are combined in a large glass bowl that has been rinsed in ambient creek water and mixed with a teflon scoop. The composite sample is transferred into sterile glass sample jars with teflon lids and stored at 4^{o} C for transportation to the laboratory for analysis. A contract lab using EPA approved methods conducts all analyses.

2.4.3 Developing Sediment Quality Curves (Q-Values Curves)

In order to take into account toxicity effects, the sediment quality curves are based on biological effects levels; no effects level (NOEL), effects level-low (ER-L), effects level-medium (ER-M), and apparent effects threshold (AET). The biological effect levels were obtained from two sources: National Oceanic & Atmospheric Administration (NOAA) Technical Memorandum NOS OMA 52 and the Florida Department of Environmental Regulation Report: Development of an Approach to the Assessment of Sediment Quality in Florida Coastal Waters. The City used the NOAA report for selecting NOEL levels for each parameter. In addition, the NOAA report was the source for the ER-M, ER-L, and AET levels. The NOAA report has established the ER-L and ER-M by determining the lower 10 and 50 percentile from sediment chemistry data collected thoughout the United States as a part of the National Status and Trends (NS&T) Program. The report also listed AET levels from the NS&T program. From this list the city staff selected the highest AET levels reported which were from *R. abronius* amphipods bioassay. The City used these effects levels to construct sediment quality curves for each parameter by assigning an index value to each effects level as shown in Table 8.

Table 8: Assignment of SQI to Parameter Specific Effects Levels

Parameter specific Effects Level	Index Value
0	**100**
NOEL (No Observable Effects Level)	**75**
ER-L (Effects Range -Low (10th percentile)	**50**
ER-M (Effects Range - Median (50th percentile)	**25**
AET (Apparent Effects Threshold)	**5**

When determining the effects level for each parameter, gaps in the available data occurred. To aid in developing a consistent protocol for constructing Q-value curves for sediment the following rules were applied:

- If the Apparent Effects Threshold is less than the Effects Range - Median, only the Apparent Effects Threshold is used.
- If there is no documented NOEL, it is omitted.
- If data are not available, the parameter will not be included in the Sediment Quality Index.

The effects levels used to construct sediment q-value curves and the actual curves are provided in Table 9. These curves may be modified when new effects data is available, however the procedure would remain the same. The EPA has recently released a new publication “The Incidence and Severity of Sediment Contamination In Surface Waters of the United States” (EPA 1997) which revises many of the effects levels developed by NOAA using additional data. The database for this and other freshwater toxicity studies will be further examined to assess whether the most appropriate critical points are being used in the sediment q-value curves.

The sediment quality index (SQI) score is determined by averaging three group q-values; metals, chlorinated hydrocarbon pesticides and PCBs, and total PAHs. The total PAH group q-value is determined by adding each of the individual PAH compound concentrations together and converting this total into a q-value using the total PAH curve. The metals q-value is determined by assigning a q-value to each of the six metals and averaging the q-values together. The same procedure is used for the chlorinated hydrocarbon pesticides & PCB group. Each individual compound's q-value is determined, and the average is the group q-value. If the reported sediment parameter concentration is less than the detection limit, the following procedure is used:

- If the detection limit is greater than the Effects Range - Low level, then the score for that parameter is not used.
- If the detection limit is less than the Effects Range - Low level, then half of the detection limit is used.

The SQI is then calculated as a number between 0 and 100 which is assigned the descriptive ratings of bad (0-25), poor (26-50), good (51-75), and excellent (76-100). These ratings were subdivided equally into eight ranges for the 1996 assessment for visual presentations. The one SQI score for the watershed mouth site is used for all EII site scores and the composite watershed score.

2.4.4 Results from Pilot Watershed Study

Results from the pilot watershed study produced some modification in the sediment quality index process. The arsenic and cadmium were added to the parameter-sampling list. The 1995 scores include cadmium. However, arsenic was not analyzed for in the past due to a laboratory error, therefore the sediment scores do not account for any arsenic concentrations that may be present. In addition, 1995 samples were submitted to two different labs. The resulting SQI for the two pilot watershed studies are provided in Table 10.

Table 9: Parameter Specific Effects Levels for Sediment Quality

	NOEL	ER-L	ER-M	AET
Metals (mg/Kg)				
Arsenic	8	33	85	93
Cadmium	1	5	9	6.7
Copper	28	70	390	1,300
Lead	21	35	110	660
Mercury	0.1	0.15	1.3	2.1
Zinc	68	120	270	960
PAHS (ug/Kg)				
Acenaphthene	22	150	650	2,000
Anthracene	85	85	960	13,000
Benzo(a)anthracere	160	230	1,600	5,100
Benzo(a)pyrene	230	400	2,500	3,000*
Chrysene	220	400	2,800	9,200
Dibenz(a,h)anthrac	31	60	260	540
Flourene	18	35	640	3,600
Fluoranthene	380	600	3,600	30,000
2-methylnaphthalene		65	670	1,900
Naphthalene	130	340	2,100	2,400
Phenanthrene	140	225	1,380	6,900
Pyrene	290	350	220	16,000
Total PAHs	**2,900**	**4,000**	**35,000**	**99,400**
Pesticides /PCBs (ug/Kg)				
PCBs	.	50	400	3100
DDD	.	2	20	43
DDE	.	2	15	15
Chlordane	.	0.5	6	17.4
Total DDT (all isomers)	.	3	350	9300

Table 10: Results of Sediment Quality Subindex for Pilot Watersheds

Creeks Sampled (1995)	Sediment Quality Scores	
Barton	43	53
East Bouldin	46	28
Fort Branch	81	95
Shoal	53	34
Williamson	-	90

2.4.5 Pilot Watershed Interpretation

The sediment quality index scores are not consistent between pilot studies. This may be a result of natural variation with sediments sampling caused by differences in grain size, total organic carbon, and acid volatile sulfides of each sample. The variation in grain size between sites may explain why Fort Branch's sediment quality score is the highest. At this site, the sediment is mostly sand-size particulate which is less likely to adsorb pollution as opposed to fine grain silt and clay size particulate. Along with Fort Branch, Williamson Creek sediment quality (90) scored in the excellent range. East Bouldin's SQI scores (46 and 28) are in the fair range. Barton and Shoal Creeks both scored in the Good and Fair range during one of the two sampling events. Barton Creek's score differed by 12 points, whereas Shoal Creek's score differed by 19 points. This spread in SQI scores is of some concern; however, more data are needed to determine what alternative methods might reduce this effect. This variation is most likely due to high sediment variability associated with the sediment sample composition and may indicate that additional grabs for compositing may be necessary in future applications.

While the limited sediment data (one site and one sample per watershed) may be representative over time due to the persistence of pollutants in the sediments, a bigger problem may be in characterizing the overall watershed by an individual site. This problem is demonstrated by the toxics measured in Barton Creek sediments, which have been consistently demonstrated at that site, but are not felt to represent the entire watershed. For larger watersheds with downstream inputs of toxics, additional sites may need to be included for sediment sampling.

2.5 Habitat Quality Index

2.5.1 Background

Protecting the habitat quality of waterways from erosion is a vital component of an urban watershed protection and management program. Not only is stabilization of the stream banks important in flood protection, but streambank erosion can signal a break down in a healthy aquatic system (Lenat, 1981). Increasing impervious cover in urban areas can radically change stream flows, causing more destructive flood events, more often. These hard, fast flows cause stream banks to fail, dropping tons of fine sediments into stream channels while at the same time moving the existing bed material frequently, making a very unstable stream channel (Leopold, 1964). The resulting erosion and instability causes severe degradation of aquatic habitat and water quality as well as huge losses of property.

During the development of the Habitat Quality Index (HQI) subcomponent, many permutations occurred in formulating the subcomponent. Originally, it was referred to as the Physical Integrity Index and consisted of eight of the twelve parameters from the EPA Habitat Assessment Field Data Sheet (Barbour & Stribling, 1993). The eight parameters used in the index from 1994 to 1996 are channel alternation, sediment deposition, embeddedness, channel flow status, conditions of banks, bank vegetation protection, disruptive pressure, and riparian vegetative zone width. In the future, the Habitat Quality Index will consist of the complete EPA habitat assessment parameters: channel alternation, sediment deposition, embeddedness, channel flow status, conditions of banks, bank vegetation protection, disruptive pressure, and riparian vegetative zone width, instream cover, epifaunal substrate, velocity and depth regimes, and frequency of riffles. Anaerobic condition was added to the EPA field sheet by City of Austin staff to evaluate the anoxic condition that can result from inundation of a site by fine sediments or eutrophication.

Also in 1996, the Pfankuch Channel Stability Evaluation protocol was added to the Physical Integrity Index. The Pfankuch Evaluation was added to survey with the belief that it would improve the level of habitat quality documentation by providing a comprehensive evaluation of stream stability and erosion through more technical and less subjective indicators than the

EPA Habitat Quality evaluation. Both the EPA Habitat Quality Index and the Pfankuch Evaluation represented 50% of the overall Physical Integrity score in the 1996 evaluation results. However, a comparison of the results of the two protocols indicated that they were highly positively correlated. Although the Pfankuch provided useful information on the stability and erosion potential of creek’s bank and substrate, in the large scope of the Watershed Protection Department’s masterplanning process, these factors were already being addressed in the erosion component of the masterplan. As a result, scoring of the HBI subcomponent will consists of only the EPA Habitat Quality Index protocol. The Pfankuch Channel Stability Evaluation will be nonscoring supplementary information. These methods will be discussed in detail in the following sections.

2.5.2 The EPA Habitat Quality Index Protocol.

The EPA Habitat Quality Index evaluation is a visual assessment of existing in-stream and riparian conditions that is conducted through field observation. Each researcher is provided a field assessment sheet (Figure 4) developed by Barbour and Striblings in 1993 describing four categories of conditions (optimal, suboptimal, marginal, and poor) for each of the following thirteen parameters:

2.5.2.1 Instream Cover

Instream cover refers to the quantity and diversity of refuge material suitable for aquatic communities. Mineral and organic materials such as boulders, cobble, gravel, submerged logs, and undercut banks form the instream cover. A complex mixture of these materials, particularly cobble and gravel, is considered excellent habitat for macroinvertebrates and fish by providing breeding areas and refuge.

2.5.2.2 Epifaunal Substrate

Epifaunal substrate is a measure of the quality of the riffle/run complex in a stream. The extent and quality of the riffles is an important factor in supporting a healthy biological community. Riffles provide diverse, oxygenated habitats where a variety of stable substrate structures like cobble and large rocks serve as refugia, feeding, and colonization sites for benthic macroinvertebrates. The larger the area of the riffle and the substrate in the riffle, the better ecosystem structure it provides.

2.5.2.3 Embeddedness

Embeddedness refers to the degree that the stream bed substrate (boulders, cobble, or gravel) is covered by fine sediment. In addition to being an indicator of the amount of erosion occurring in a watershed, embeddedness is also an indicator of the quality of the existing aquatic habitat for macroinvertebrates and fish. The deposition and accumulation of fine sediment in bed substrate can destroy or degrade otherwise suitable aquatic habitat. Conditions where fine sediment covers less than 25% of the stream substrate are considered excellent.

2.5.2.4 Velocity/Depth Regimes

Velocity/Depth regimes refer to quantity and diversity of flow dynamics. The stream's ability to provide and maintain a stable and diverse aquatic habitat is related to the occurrence of diverse velocity/depth regimes. The best creeks will have all four velocity/depth regimes (slow-deep, slow-shallow, fast-deep, and fast-shallow).

2.5.2.5 Channel Alteration

Channel alteration refers to human induced modifications in the natural geometry of the stream channel. Modifying a stream channel by removing natural meanders and reinforcing embankments with hard engineered materials not only destroys riparian buffers and alters naturally occurring pool/ riffle complexes, but also increases stream velocity and the potential for scouring and sediment loss downstream.

2.5.2.6 Sediment Deposition

Sediment deposition refers to the changes in a stream's morphology resulting from the erosive forces of water and the accumulation of mobile sediments. The amount and pattern of sediment deposition is indicative of the severity of watershed and stream bank erosion.

2.5.2.7 Frequency of Riffles

Riffle areas are considered to be excellent habitat for benthic macroinvertebrates because of the high dissolved oxygen and cleaned out pore space between substrate particles. Riffle areas represent a more diverse habitat for aquatic communities than areas with uniform depth. The EII assessment scores sites with frequently occurring riffle areas as an optimal condition.

2.5.2.8 Channel Flow Status

Channel flow status refers to the volume of water present in the stream. The EII scores channel flow status by visually estimating the width of water within the channel and the amount of exposed channel substrate. The more fully the channel is covered by water the higher the channel flow status score.

2.5.2.9 Condition of Banks

Condition of banks refers to the current stability of the bank; whether there is evidence of recent erosion or bank failure and the magnitude of its occurrence. The EII scores this parameter by visually estimating the stability of the stream banks and the current percentage of erosion or bank failure present at the site being assessed.

2.5.2.10 Bank Vegetation Protection

Stream bank vegetation protection refers to the amount of vegetative cover present along both stream banks, which provides water quality and erosion benefits. The EII scores this parameter based on a visual estimate of the percentage of the stream bank surface covered by vegetation. Banks with over 90 % vegetation are scored as optimum.

2.5.2.11 Disruptive Pressure

Disruptive pressure refers to the amount of disturbance or maintenance to vegetation occurring along the stream bank. This parameter is reflective of land use and cultural practices (i.e., grazing and mowing). The EII scores this parameter based on a visual estimate of the amount and severity of disruption to the stream side vegetation.

2.5.2.12 Riparian Vegetative Zone Width

Riparian zone width refers to the width of the natural vegetative zone that is associated with an undisturbed stream ecosystem. This parameter combines both a physical and visual assessment, which is made on the least buffered side of the stream. The EII scores this parameter by visually estimating the width of the riparian zone and the amount of human disturbance occurring within this zone.

2.5.2.13 Anaerobic Conditions

Anaerobic stream conditions refer to conditions where dissolved oxygen is limited and a healthy exchange of gases does not occur, often due to sedimentation or eutrophication. Under anaerobic conditions, chemical reactions begin to occur resulting in the formation of a black filmy substance under submerged rocks and other substrate materials. Often, there is an associated foul odor. Anaerobic stream conditions severely limit the aquatic community of a stream system. The EII rates sites with excessive anaerobic conditions poorly.

2.5.3 Stream Stability Evaluation

This component of the Habitat Quality Index was added for the 1996 survey to improve the level of habitat quality documentation and is not used in the calculation of the Habitat Quality Subindex score. It evaluates stream stability and erosion using more technical and less subjective indicators than the EPA Habitat Quality evaluation. Dale J. Pfankuch developed this method for the United States Department of Agriculture in 1975 with the following goals in mind:

"Each parameter in this method is designed to answer three basic questions:
What are the magnitudes of the hydraulic forces at work to detach and transport the various organic and inorganic bank and channel components?

How resistant are these components to the recent stream flow forces exerted on them?
What is the capacity of the stream to adjust and recover from potential changes in flow volume and/or increases in sediment production?" (Pfankuch, D. J., 1975)

This method provides information about the capacity of streams to adjust and recover from potential changes in flow and/or increases in sediment production by systematically measuring and evaluating the resistive capacity of stream channels to the detachment of bed and bank materials. A brief review of each of the parameters is included.

2.5.3.1 Landform Slope

Bank slope determines the lateral extent and ease to which banks can be eroded and the potential slough that can enter the water. Banks with angles greater than 60% would erode into streams by gravity alone, if denuded of their vegetative protection. This angle is measured using a Suunto Clinometer model PM-5/360 PC, which measures percent slope.

2.5.3.2 Mass Wasting

Mass movement of banks by slumping or sliding introduces large volumes of soil and debris into the channel suddenly, causing constriction, introducing huge amounts of fine material into the channel and increasing sedimentation rates. This parameter is estimated visually, evaluating the extent of the problem categorically, according to the text.

2.5.3.3 Debris Jam Potential

This inventory item assesses the potential for increasing woody impediments to the natural direction and force of flow in the channel. A visual estimate of volume and size of these constituents is made using the defined categories.

2.5.3.4 Bank Protection from Vegetation

Density, coverage and root mat continuity all provide protection of the bank from erosion and overland flows. This parameter is a visual estimate of plant percent cover, density, vigor and root mass integrity.

2.5.3.5 Degree of Entrenchment

This ratio of bankfull width to valley width is a relative index of channel shape and incision. The lower the entrenchment ratio (<1), the more incised and unstable the channel is due to its containment of peak flows and the inability of the stream to break out into the flood plane. This parameter was modified slightly to accommodate the urban use of this protocol. Measurements of bankfull width/depth and valley width are made using a survey rod and tape measure.

2.5.3.6 Bank Rock Content

This parameter measures the relative resistance of the banks to detachment by flow forces. A high percentage of rock and/or large diameter rock in the banks will be more resistant to erosion. Low scoring banks will be mostly soil, clay or sand.

2.5.3.7 Obstructions, Deflectors, Sediment Traps

Objects within the stream channel change the direction and velocity of flow. Sediment traps are good indicators of natural dams/diversions in the channel that are increasing channel damage. A visual estimate of abundance and severity of problem is made within the text categories.

2.5.3.8 Cutting

One of the first signs of channel degradation is a loss of the footing of the bank at the bottom of the channel. Vertical walls with raw soils are indicative of erosive flows, downstream sedimentation and future instability. Their severity is estimated using text-defined ranges of cut height and extent.

2.5.3.9 Deposition

The appearance of sand and gravel bars where they previously did not exist is a good indicator of upstream erosion. This parameter estimates the amount and size of material that has recently been moved in and/or around a channel.

2.5.3.10 Rock Angularity

Rocks from stratified, metamorphic formations break out and work their way into channels as angular fragments that resist tumbling and detachment. Resistance to movement is evaluated by visually evaluating the sharpness of rock angles and shapes using the defined categories. The less rounded and smooth a rock is the more stable it is in the substrate matrix.

2.5.3.11 Brightness

Rocks in motion “gather no moss”, algae or stain. The more substrate moves the brighter it will be relative to substrate that is stable and has not been scoured clean. This parameter is visually taken using described percentages of bright material.

2.5.3.12 Consolidation or Particle Packing

Under stable conditions, the array of rock and soil particle sizes pack together, filling voids over time and making an erosion resistant armour. Unstable substrates will form in loose assortments. This evaluation is done visually using defined categories based on tight vs. loose packing.

2.5.3.13 Bottom Size Distribution and Percent Stable Materials

Changes or shifts from the natural variation of component size classes and the percentage of all components that are judged to be stable are evaluated in this parameter. Relative dominance of any particle size or a large gap between two dominant substrate sizes can be an indicator of altered hydrologic cycles. Both size distribution and percent stable materials are estimated visually based on text categories.

2.5.3.14 Scouring and Deposition

Items of size, angularity and brightness are indicators of the scouring and deposition that is taking place along the channel bottom. This parameter rates these general items using percentages of the bed substrate being moved or disturbed on a regular basis. The higher percentage of the bottom that is in a state of flux, the lower the score.

2.5.3.15 Clinging Aquatic Vegetation

If there is any stability established in the channel, it will quickly be colonized by plants and algae. This item evaluates the primary production indicators of stream stability by estimating their community and coverage.

2.5.4 Procedure for Scoring

The EII Index procedure for assessing habitat quality is currently based on the Environmental Protection Agency's (EPA) Rapid Bioassessment Protocols (RBP's). The Stream Reach Inventory and Stream Stabiltiy Evaluation protocol (USDA, 1974) developed by Dale J. Pfankuch is utilized but not included in the final scoring of the Habitat Quality Subindex

Parameters from the Physical Habitat Quality form are ranked along a 20-point scale with 20 being the most optimal condition and 0 being the poorest condition (Figure 4). Scores for each parameter are then added together. The total site score is then divided by 260 (the maximum possible score for the measured parameters) and then multiplied by 100 to give a percent score for each site. Individual site scores for each site along a creek are then averaged to give a composite site or watershed score for each creek.

The Pfankuch Reach Inventory is scored in a similar manner to the above protocol, with four categories (Excellent, Good, Poor and Bad) along a continuum (Fig. 5). However, each parameter is weighted depending on its importance to that zone of the stream channel, instead of being weighted equally as they are in the Habitat Quality Index. Additionally, scores go from the lowest in the excellent category to the highest in the Poor category, which is the opposite of the habitat evaluation. Each total site score has a maximum possible of 152 (the worst) and a minimum of 38 (the best), which were set to 0 and 100 respectively. Linear interpolation was used to assign scores between the maximum and minimum for each site evaluated. If replicates were done for any sites (QA samples) the mean of all scores for that site within that survey period were calculated for a final Stream Stability Evaluation score.

2.5.5 Results from Pilot Watersheds

A summary of the results for the scoring parameters observed during the pilot studies is provided as Table 11.

2.5.6 Pilot Watershed Interpretation

In general, the habitat quality scores were consistent with the level of development found in the pilot watersheds. As expected, Shoal, Fort, and East Bouldin clustered in a lower range of scores than Barton. Surprisingly, East Bouldin (11.5), one of the more densely developed urban streams, scored closer to Williamson (12.1), a sub-urban stream, than the other urban creeks in the 1995 survey. This could have been due to local site impacts depressing individual Williamson Creek scores, or the impact of an intervening wet period that depressed the scores in the entire watershed. Regardless, the largest range was consistently between the relatively unimpacted Barton Creek watershed and the remainder of the more urbanized pilot watersheds. Some variation in the site scores from 1994 to 1995 could have resulted from seasonal influences. The majority of the physical parameters are sensitive to vegetative differences and seasonal flow induced changes in the streams. Depending on the setting and local hydrology of the sites, these changes could influence some sites differentially. For this reason, a consistent seasonal sampling period may be important for conducting the EII. Also the importance of nonscoring parameters and photo documentation in interpreting the data obtained for these parameters is noted.

Figure 3: Habitat Quality Index Assessment Field Sheet

Habitat Quality Index (Riffle/run prevalence)

Rating Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Instream Cover	>50% mix: Boulder, cobble, logs, undercut banks...(Stable)	30-50% mix: Boulder, cobble...(Stable); adequate habitat	10-30% mix of stable habitat; availability less than desirable	<10% mix of stable habitat; lack of habitat is obvious
SCORE:	20-16	15-11	10-6	5-0
2. Epifaunal Substrate	Well dev. riffle/run; riffle = width stream; length = 2X width; abundance of cobble	Riffle = width stream; length = 2X width; Abundance of cobble; Boulders/gravel common	Run area poss. lacking; riffle = stream width; length = 2X width; grav./bould./bed. prevelant; some cobble	Riffles or run nonexistant; large boulders/bedrock prevelant; cobble lacking
SCORE: _______	20-16	15-11	10-6	5-0
3. Embeddedness	Gravel, cobble and boulder particles; 0-25% surrounded by fine sediment	Gravel, cobble and boulder particles; 25-50% surrounded by fine sediment	Gravel, cobble and boulder particles; 50-75% surrounded by fine sediment	Gravel, cobble and boulder particles; > 75% surrounded by fine sediment
SCORE:	20-16	15-11	10-6	5-0
4. Velocity/Depth regimes	All 4 velocity/depth regimes present (Slow-deep, sl.-shal., fast-deep, fast-shal.)	Only 3 of 4 regimes present (fast-shallow gets most weight)	Only 2 of 4 regimes present (fast-shallow or slow-shallow get most weight)	Dominated by 1 regime (usually slow-deep)
SCORE:	20-16	15-11	10-6	5-0
5. Channel Alteration	No channelization or dredging present	Some chan. present; evidence of past chan. (dredging) but not recently; >20 years.	New embankments present on both banks; 40-80% of stream reach channelized/disrupted	Banks shored with gabion or cement; >80% of the stream reach channelized/Disrupted
SCORE:	20-16	15-11	10-6	5-0
6. Sediment Deposition	Little or or no enlargement of islands or point bars; less than 5% of bottom affected by sediment dep.	Some new increase in bar formation (course gravel); 5-30% of bottom affected; slight dep. in pools.	Moderate dep. of new gravel/ course sand on bars; 30-50% of bottom affected; sed. at contriction/bends; moderate dep. of pools prevalent	Heavy deposits of fine material; increased bar dev.; >50% bottom changing frequently; pools almost absent due to sediment dep.
SCORE:	20-16	15-11	10-6	5-0
7. Frequency of riffles	Riffles frequent;distance between riffles/width of stream = 5-7.	Riffles infrequent; riffle/width = 7-15	Riffles occasional (or bend); bottom contours provide some habitat; riffles/width = 15-25	Flat water or shallow riffles; poor habitat; riffles/width > 25
SCORE:	20-16	15-11	10-6	5-0
8. Channel Flow Status	Water reaches base of both lower banks; minimal amount of channel subs. exposed	Water fills >75% of channel; <25% of channel substrate is exposed	Water fills 25-75% of available channel; riffle substrates are mostly exposed	Very little water in channel and mostly present as standing pools.
SCORE:	20-16	15-11	10-6	5-0
9. Condition of Banks	Banks stable; no evidence of erosion or bank failure	Mod. stable; infreq., small areas of erosion mostly healed over	Mod. unstable; up to 60% of banks in reach have areas of erosion	Unstable; "raw"eroded areas freq.; 60-100% of bank has erosion scars
SCORE:	20-16	15-11	10-6	5-0
10. Bank Vegetative Protection	>90% streambank surfaces covered by veg.	70-90% streambank surfaces covered by veg.	50-70% streambank surfaces covered by veg.	< 50% streambank surfaces covered by veg.
SCORE: _______	20-16	15-11	10-6	5-0
11. Grazing or other Disruptive Pressure	Vegetative disruption (grazing, mowing) minimal/ not evident; most plants allowed to grow naturally	Disruption evident but not affecting full plant growth potential; >50% potential plant height remains	Disruption obvious; patches bare soil/closely cropped veg. common; <50% pot. plant height remains	Disruption of steambank veg. is very high; veg. has been removed to 2" or less
SCORE: _______	20-16	15-11	10-6	5-0
12. Riparian Vegetative Zone Width (Least buffered side)	Rip. zone >18 meters; human activities (parking lots, roads, clearcuts, lawns, crops) have not impacted zone	Width of rip. zone 12-18 M.; human activities have impacted zone only minimally	Width of rip. zone 6-12 M.; human activities have impacted zone a great deal	Width of rep. zone < 6M.; little or no rip. vegetation due to human activities
SCORE:	20-16	15-11	10-6	5-0
13. Anaerobic condition	No evidence; healthy exchange of gases	Minimal; slight evidence under rocks	Moderate condition; thin layer, smell present	Highly anoxic; thick black layer, putrid
SCORE:	20-16	15-11	10-6	5-0

TOTAL: _______ **Fish: Presence Absence (Circle one)**

(Barbour & Stribling-An Evaluation of a visual-based technique for assessing stream habitat structure. Draft-5/93)

NOTES:

Figure 4: Pfankuch Reach Inventory Evaluation Form

EII Reach Inventory and Channel Stability Evaluation

EII Site Number:	EII Site Name:	Stream:	Staff:	Date: Time:
Days since last rain (+0.25"):	Avg. stream width:	Avg. stream depth:		Est. stream discharge (cfs):
Note flow condition (Flooding, high flow, moderate flow, low flow or dry):		Bankfull width: Riffle 1 = Riffle 2=		Pool 1= Pool 2=

Parameter	Excellent	Good	Fair	Poor	Score
Upper Banks (From normal high water mark to the next break in general slope. Relatively perennial with terr. plants and animals)					
Landform Slope	Bank slope gradient < 30% (2)	Bank slope gradient 30-40% (4)	Bank slope gradient 40-60% (6)	Bank slope gradient > 60% (8)	_____
Mass Wasting (existing or potential)	No evidence of past or potential for future mass wasting into channel. (3)	Infreq. and/or very small, mostly healed over, low future potential. (6)	Moderate freq. & size, with some raw spots eroded by high flows (9)	Freq. or large, causing sediment loss nearly yearlong (12)	_____
Debris Jam Potential (floatable objects)	Essentially absent from immed. channel (2)	Present, but mostly small twigs and limbs (4)	Present, volume and size are both increasing (6)	Moderate to heavy amounts, larger sizes (8)	_____
Bank Protection From Vegetation	90% + plant density, vigor and variety suggest deep, dense root mass (3)	70-90% density, fewer species or lower vigor suggest less dense or deep root mass (6)	50-70% density, lower vigor and still less species form a shallow/discont. root mass (9)	>50% density, fewer species, less vigor indicate poor, discont. or shallow root mass (12)	_____
Lower Banks (Intermittently submerged section of channel from waters edge to normal high water mark)					
Degree of Entrenchment (Entrenchment ratio*)	Little or no entrench., ratio >2.5 (1)	Minimal entrench., ratio of 2.0-2.5 (2)	Moderate entrench., ratio of 1.2-2.0 (3)	Highly entrenched, ratio <1.2 (4)	_____
Bank Rock Content	+65% w/ large, angular boulders (12" dia.) abund. (2)	40-65% small boulders to cobble (6-12" dia.) (4)	20-40% with most in the 3-6" dia. class. (6)	<20% rock fragments of gravel size (2-4" dia.) (8)	_____
Obstructions, Deflectors, Sediment Traps	Rocks, old logs firmly embedd., flow pattern of pool/riffle stable w/out cutting or deposition (2)	Some present, causing erosive cross currents and minor pool filling, obstructions and deflectors newer and less firm (4)	Moderately frequent, mod. unstable obstruct. & deflect. move with high water causing bank cuttin and filling of pools (6)	Freq. obstruct. and deflect. cause bank erosion yearlong, sed. traps full, channel migration occuring (8)	_____
Cutting	Little or none evident, infrequent raw banks less than 6" high (4)	Some, intermitt. at outcurves & constrictions, raw banks be up to 12" high (8)	Significant, cuts 12-24" high, root mat overhangs and sloughing evident (12)	Almost continuous cuts some over 24" high, failure of overhangs frequent (16)	_____
Deposition	Little or no enlargement of channel or point bars (4)	Some new increase in bar formation, most from course gravels (8)	Moderate deposition of new gravel & course sand on old/new bars (12)	Extensive dep. of predom. fine particles, accelerated bar development (16)	_____
Bottom (Generally submerged portion of channel, totally aquatic)					
Rock Angularity	Sharp edges and corners, plane surfaces roughened (1)	Rounded corners & edges, surfaces smooth & flat (2)	Corners & edges well rounded in two demensions (3)	Well rounded in all dimensions, surf. smooth (4)	_____
Brightness (Clean rocks)	Surfaces dull, darkened or stained, gen. not bright (1)	Mostly dull but may have up to 35% bright surfaces (2)	Mixture, 50-50% dull and bright, (+,- 15 %) (3)	Predom. bright, 65% exposed or scoured surf. (4)	_____
Consolidation or Particle Packing	Assorted sizes tightly packed and/or overlapping (2)	Moderately packed with some overlapping (4)	Mostly a loose assortment with no apparent overlap (6)	No packing evident, loose assortment, easily moved. (8)	_____
Bottom Size Dist. & % Stable Materials	No change in sizes evident, stable materials 80-100% (4)	Distribution shift slight, stable materials 50-80% (8)	Moderate change in sizes, stable material 20-50% (12)	Marked dist. change, stable materials 0-20% (16)	_____
Scouring and Deposition	Less than 5% of bottom affected by scouring and deposition (6)	5-30% affected, scour at constrict. and where grades steepen, some dep. is pools (12)	30-50% affected, dep. & scour at obstruct. constrict. and bends, pools filling (18)	More than 50% of bottom in a stat of flux or change nearly yearlong (24)	_____
Clinging Aquatic Vegetation (moss, algae)	Abundant, growth largely moss-like, dark green, perennial, in swift flow also. (1)	Common, algal forms in low velocity & pools, moss in pools and riffles (2)	Present but spotty, mostly in backwater areas, seasonal blooms make rocks slick (3)	Perennial veg. scarce or absent, yell.-gr., short term blooms may be present. (4)	_____

** Entrenchment ratio = Width of the flood-prone area (width at 2X bankfull height) divided by width at bankfull.*

Reach Score of : <38 = Excellent, 39-76 = Good, 77-114 = Fair, > 115 = Poor **Total:**

Notes: (Large erosion sites, niche-points, massive deposition, excessive debris, exceptional integrity,etc…)

Table 11: Results of Habitat Quality Index for Pilot Watersheds

Survey

Habitat Quality		Shoal	W.C.	Fort	E.B.	B.C.
1	Embeddedness	10.3	11.2	8.0	14.0	16.3
2	Channel Alteration	9.8	13.8	11.5	13.5	16.3
3	Sediment Deposition	13.3	9.5	5.5	12.0	16.3
4	Channel Flow Status	9.8	9.8	11.5	12.0	18.3
5	Condition of Banks	10.5	13.7	8.5	9.0	16.0
6	Bank Vegetative Protection	8.3	14.7	8.8	10.5	12.7
7	Disruptive Pressure	12.2	13.8	13.5	13.0	16.7
8	Rip. Veg. Zone Width	7.2	10.2	10.8	8.3	13.3
	TOTAL	81.5	96.7	78.0	92.3	126.0
	AVG.	10.2	12.1	9.8	11.5	15.8
	Creek/Site Percentages	**50%**	**61%**	**49%**	**58%**	**79%**

1994 Survey

Habitat Quality		Shoal	Fort	E.B.	B.C.
1	Embeddedness	11.4	5.5	11.0	19.3
2	Channel Alteration	10.4	11.25	12.3	20.0
3	Channel Flow Status	9.3	11.0	13.0	20.0
4	Condition of Banks	9.0	6.25	7.8	13.0
5	Bank Vegetative Protection	7.6	8.25	8.0	13.0
6	Disruptive Pressure	10.7	13.5	12.3	18.7
7	Rip. Veg. Zone Width	6.9	8.25	3.3	18.0
	TOTAL	65.3	64.0	67.5	122.0
	AVG.	9.3	9.1	9.6	17.4
	Creek/Site Percentages	**47%**	**46%**	**48%**	**87%**

In general, the categorization of the pilot watersheds is consistent across the two years of surveys. A larger spread is noted in the urban creeks in 1995 data and all scores for urban creeks are higher in 1995 than in 1994. In contrast, the score for Barton Creek is slightly lower in 1995 than in 1994. No consistent trends in site data are observed from upstream to downstream for these watersheds. This may be due to the localized hydrologic effects of tributaries entering these creeks or just heterogeneity in the stream habitat quality in this region.

2.6 Aquatic Life Support

2.6.1 Background

In an effort to protect and manage our water resources, it is important to understand the ecological function and relationship between aquatic habitat and the biological communities it supports. Aquatic Life Support is an integrated taxonomic monitoring approach to assessing the biological integrity of Austin's watersheds. Biological surveys of different communities provide assessment information on different trophic levels that exhibit different ranges of sensitivity. The EII evaluates the composition and structure of the aquatic benthic community by assessing the Macroinvertebrate Community Structure (MCS), Diatom Community Structure (DCS), percent cover of filamentous algae, chlorophyll-*a* concentration (including VSS and pheophytin) and fish presence/absence.

Since the study area includes two ecoregions (Central Texas Plateau and Blackland Prairie), reference sites was selected to represent each region. Criteria for reference site selection included assessments of abiotic factors such as habitat, substrate, embeddedness, and canopy cover, as well as biotic factors such as abundance, diversity, pollution tolerance values, and percent dominance of major taxa. The reference site represents the "best obtainable biological condition" with the least amount of impacts from point and non-point source pollution and habitat degradation. Based on the above criteria, sites were selected on Bull Creek for the western watersheds (Central Texas Plateau) and Walnut Creek for the eastern watersheds (Blackland Prairie).

The western reference site is situated on Bull Creek in the City of Austin's St. Edward's District Park. Bull Creek is a spring-fed system that maintains at least minimal flow during extended drought conditions, unlike many of the intermittent streams in the Austin area. This reference site is representative of a relatively non-degraded condition since development and impervious cover in this reach of the watershed is estimated to be less than 5 percent. The riffle site is downstream of the crossing of Bull Creek and Spicewoods Spring Road near the northern border of the park. The riffle area is comprised of medium to large cobble (5 -

20 cm. in diameter) with a low degree of embeddedness and limited shading from canopy cover.

The eastern reference site is located downstream in the Walnut Creek watershed near the crossing of Springdale Road. This site is upstream of the Walnut Creek Wastewater Treatment Plant and the confluence with the Colorado River. As with Bull Creek, Walnut Creek maintains perennial flow along most of its channel length due to spring discharges. In the eastern portion of the watershed, soils are predominantly expansive clay with sand and gravel alluvium. These soil types, along with high erosional banks throughout the watershed, produce varying degrees of embeddedness and deposition, even at the reference site. This control site was chosen based on the same criteria as the western reference site and represents the "best obtainable condition" for the eastern ecoregion.

If Site ≤ Reference:

$$\text{Percent Reference} = \frac{\text{SiteValue}}{\text{Reference Value}} \times 100$$

If Site > Reference:

$$\text{Percent Reference} = \frac{\text{Reference Value} - (\text{Site Value} - \text{Reference Value})}{\text{Reference Value}}$$

2.6.2 Parameters

2.6.2.1 Macroinvertebrate Community Structure

The community structure of benthic macroinvertebrates reflects short and long term impacts to the aquatic system from both point and non-point source pollution. In addition, sequential sampling and analysis of MCS can monitor physical habitat degradation or improvement.

Benthic macroinvertebrates are collected using the following procedure:

- All field teams will bring with them the following: one surber sampler (1 ft 2, 600*u*m mesh-size), one Caton sub-sampler, sample vials and a picking pan for each person who will be sorting.
- Three surber samples, including all detritus, will be collected in the bag from the bottom, middle and top parts of the riffle and composited in the sub-sampler, distributing material evenly throughout grid.
- At this point, abundance is noted:
  - For high abundance samples (>1000 organisms), one grid (out of 30) will be randomly selected which will be removed and transferred to the picking pan to be picked in it's entirety. Sequential grids will be picked until the target number of 200 organisms is reached (+or- 20%).
  - Lower abundances will require more than one grid per person picking (2-9). As a guide, if each grid has < 7 organisms, you will have to pick the whole pan to get your target. Think rapid and pull enough grids to give each picker ~25 – 50 orgs. These adjustments can be made as you go.
  - Extremely low abundance samples can be picked in their entirety and supplemented with sequential surbers until the target number of organisms is reached (200 +/- 20%). However, be sure to maintain the original 3 surber composite discrete, and each subsequent surber after that discrete as well (3-surber composite = 1 sample in DB; each subsequent surber = 1 sample in DB. Always record # of surbers, # of grids, Total # of estimated orgs)
- The number of grids/surbers subsampled is noted along with the estimated number of organism in each grid/surber. We need to be able to document level of effort (area) to reach our target number (200).
- Have each sorted pan (grids or surbers) reviewed by a different field staff than the one who picked it for quality control.
- Preserve the detritus from 1 out of every 10 samples and have them lab verified to monitor our percent recovery.

The macroinvertebrate community structure score will include the following variables or "metrics": Hilsenhoff Biotic Index (HBI), EPT to Chironomidae ratio, taxa richness, percent dominance of most abundant taxon, number of functional feeding groups, and Simpson evenness. The MCS score, which combines all the above metrics together, will represent 30 percent of the total Aquatic Life Support score.

2.6.2.2 Diatom Community Structure

Diatom communities represent a lower trophic level then the MCS and therefore are a different measure of stream integrity. In general diatoms respond more quickly to changes in both their physical and chemical environments than macroinvertebrates and can potentially indicate low level changes in water quality that may not be apparent in the MCS.

Diatom community collections for the EII are made from hard substrates (cobble) in the same riffle that is sampled for benthic macroinvertebrates. Samples from three separate rocks are composited into one sample. Duplicate samples will be collected from 10% of the total number of sites. The collection procedure is as follows:

1. Prior to collecting material from the stream, examine the collection equipment for debris or leftover material. Rinse everything thoroughly and remove any remaining material before beginning sampling.
2. Collect three rocks from throughout the riffle (upstream, midstream and downstream). The objective is to collect a single composite sample that is representative of the periphyton found at the site. Lay a small petri dish (47 cm^2 area) on a flat portion of the rock’s surface and mark the area to be sampled. Place the rock in a shallow pan and scrape the marked area thoroughly with a wire brush. Using ambient creek water, wash the material off the rock into the pan. Material from all three rocks is to be composited into one 120 ml brown plastic sample bottle, being careful that the total volume of the sample does not exceed the bottle volume. Pans and brushes should be rinsed thoroughly and picked free of additional algae. Any remaining material should be added to the sample container.

3. Collect a duplicate sample if the site is designated as such.
4. Sample bottles should be labeled with site name, site I.D. number, date of collection, and the collector's name.
5. Samples should be placed on ice for transport laboratory.
6. NOTE: in cases where samples will not be processed within one week, they should be preserved using 2.5 mL of M-3. Alternatively, if the preservative M-3 is not available, the samples should be allowed to settle overnight, then approximately 50% of the sample water decanted and sample bottle refilled with 70 % isopropyl alcohol.

ERM staff developed the Diatom Community Structure (DCS) index using related state and national programs as guides. The inclusion of two distinct biological communities provides a stronger base for aquatic life determination. The diatom community structure score combines the Percent Similarity Index and the Pollution Tolerance Index, which together comprise 25 percent of the total Aquatic Life Support score.

2.6.2.3 Algae Percent Cover

Algae percent cover is visually estimated at each study site, as described in the Non-Contact Recreation assessment form (Appendix???). Algae percent cover is incorporated into the EII index based on the assumption that a site is considered impaired after a certain percent of the area of a stream is covered by algae.

2.6.2.4 Chlorophyll- a

There are three values involved in this calculation; Volatile Suspended Solids (VSS), pheophytin, and chlorophyll-*a*. Each represents a different aspect of the algae and plant growth at a site. VSS indicates total biomass at a site. Pheophytin is a breakdown product of chlorophyll-*a* and indicates the volume of dead plant matter at a site. Chlorophyll-*a* is a photosynthetic pigment which pigment that represents live algal biomass at a site. The combination of these three numbers gives a representation of primary productivity at the time of sampling. The collection technique for these parameters is similar to that for diatoms. Important differences are in bold.

1. Prior to collecting material from the stream, examine the collection equipment for debris or leftover material. Rinse everything thoroughly and remove any remaining material before beginning sampling.
2. Collect three representative rocks from throughout the riffle (upstream, midstream and downstream). Lay a small petri dish (47 cm^2 area) on a flat portion of the rock's surface and mark the area to be sampled. Place the rock in a shallow pan and scrape the marked area thoroughly with a wire brush. Using ambient creek water, wash the material off the rock into the pan. Material from all three rocks is to be composited into one **250 ml plastic sample bottle**, being careful that the total volume of the sample does not exceed the bottle volume. Pans and brushes should be rinsed thoroughly and picked free of additional algae. Any remaining material should be added to the sample container.
3. Collect a duplicate sample if site is designated as such.
4. Sample bottles should be labeled with site name, site I.D. number, date of collection, **time of collection**, collecter's name, and **ice preservation.**
5. Immediately after collection, samples should be kept in the dark and placed on ice for transport to laboratory for analysis. The Chlorophyll-*a* /Productivity score represents 25 percent of the total Aquatic Life Support score.

2.6.2.5 Fish Presence/Absence

This simple methodology documents the presence or absence of fish at each study site, based on visual assessment. In the future, this metric may be expanded to include a modified version of the Index of Biotic Integrity. The Fish presence/absence score is recorded on the Habitat Quality Index sheet and the value represents 10 percent of the total Aquatic Life Support score.

2.6.3 Procedure for Scoring

2.6.3.1 Calculation of the EII Aquatic Life component

Because the Aquatic Life component of the EII takes so many different types of data into account, it is somewhat complex in explanation, though fairly simple numerically. Each of the five sections is calculated separately then given its designated weighting in the final calculation.

2.6.3.2 Macroinvertebrate community structure

There are six evenly weighted metrics used to describe the macroinvertebrate community structure. Most of these are taken directly from the EPA's Rapid Bioassessment Protocols (Level III). For indices with no explicit scale it was assumed that the reference site was the best attainable set of values rather than assigning an arbitrary scale.

The first measure is the Hilsenhoff Biotic Index (HBI) which is based on species tolerance classifications that were modified for the Austin area. In this metric, macroinvertebrates with a low tolerance of pollutant levels are given low values and those with high tolerance, high values. A score for a site is calculated by adding all the tolerance values together for the representative sample. The lower the score the more pollution sensitive the community is, the higher the score, the more pollution tolerant the community is. Since the RBP scale gives minimally impacted sites high values, subtracting the index value from its highest possible value reverses the scales. This value is then placed on a 0-100 scale for the EII.

$$HBI = \sum \frac{x_i t_i}{n}$$

where

x_i = number of individuals within a species

t_i = tolerance value of a species

n = total number of organisms in the sample

The second metric used is the EPT to Chironomidae index, which gages the abundance of pollution intolerant individuals in the Ephemeroptera, Plecoptera and Trichoptera (EPT) groups relative to the Chironomidae family, which is generally considered to be tolerant to pollution. The metric is the ratio of the number of individuals in the EPT group to the number of EPT individuals plus the number of Chironomidae individuals. This is a modified metric that reflects relatively low numbers of Chironomidae found in EII samples and appears to be more appropriate than the EPT to Chironomidae ratio, which is the more common form of this metric. To convert this ratio to the 0-100 point EII scale, the site score is divided by a reference site score to get a percent value, which is then multiplied by 100.

Taxa richness, or the total number of taxa in a sample, is probably the most common metric used to measure benthic community health. Generally a higher number of taxa in a sample indicates a more diverse and less degraded community and therefore higher water quality. Again, this score is converted to a 0-100 scale by dividing the sample taxa richness by a reference site taxa richness to get a percent, which is then multiplied by 100.

Percent dominance, a simple measure of the structural evenness of the population, like the HBI, is generally reported on a scale opposite to the EII. High % dominance values in a community are considered "unhealthy" while lower values are considered "healthy". Subtracting the % dominance value from the highest possible value (100) for the EII score reverses the scale, allowing it to be used for EII calculations. This metric is the number of individuals in the dominant taxon divided by the total number of individuals.

Number of functional feeding groups places genera into several groups according to how they feed (Merrit and Cummins, 1993). The number of feeding groups at a site reflects the diversity of the food source and relative stability of the site, and is therefore a measure of aquatic health. The total number of functional feeding groups is compared to a reference value to get a percent, which is then multiplied by 100.

Simpson evenness is measure of the evenness of a species distribution in a sample (Pielou, 1969). It is similar to the percent dominance metric but takes into account distribution of all taxa. Simpson Evenness is calculated as follows and is compared to a reference condition for a percent-of-reference value, which is multiplied by 100 to get to the 1-100 EII scale.

$$\text{Simpson Evenness} = \frac{1-\left(\dfrac{\sum_i n_i(n_i-1)}{N(N-1)}\right)}{\log_{10}(\text{number of taxa})}$$

where

n_i = count of taxa *i*

N = Total count

The total Macroinvertebrate Community Structure score is calculated by taking the average of the 6 values above and multiplying it by 0.3. If the total number of individuals (benthic macroinvertebrates) at a site is very low, the metrics may produce unreliable values. Also, these very low counts can be indicators of degraded areas. Thus, when the total count was less than 50 organisms, the macroinvertebrate community structure value was set to zero.

2.6.3.3 Diatom community structure

Percent similarity and Pollution Tolerance Index (PTI) are the two metrics used to describe diatom community structure. As with the macroinvertebrates, for indices that have no explicit scale, it was assumed that the reference site is the best attainable set of values rather than assigning an arbitrary scale. Other commonly used metrics such as taxa richness, Simpson evenness, and simple matching were not incorporated into the Diatom scoring process because their spatial and temporal responses were not consistent in the pilot EII watershed study.

Percent similarity is the first metric in the scoring procedure. It compares the presence and absence as well as the abundance of diatoms species compared to a reference condition. The values are on a percent-possible scale.

$$\text{Percent Similarity} = \sum_{\text{species } i} \min\left(\frac{r_i}{R_T}, \frac{n_i}{n_T}\right)$$

where,

r_i = Number of individuals in species *i* at the reference site.

R_T = Total number of individuals at the reference site.

n_i = Number of individuals in species *i* at the other site.

n_T = Total number of individuals at the other site.

The second metric in the scoring is the Pollution Tolerance Index (PTI), which was developed in Kentucky and is used to scale sites based on a species' tolerance to pollution. Based on historical data and state and national testing, tolerance values are assigned to common species of diatoms. High values are indicative of pollution intolerant species while low values are assigned to tolerant species. Local species for which pollution tolerant values were not available were not included in the calculation. Each species collected at a site survey is multiplied times its tolerance value resulting in a site total. This value is divided by the reference site "best attainable" value and then multiplied by 100 to get a 1-100 site score. The final diatom community structure value is calculated by taking the average of the two scoring metrics and multiplying it by 0.25.

2.6.3.4 Algae percent cover

The 0-20 value, (from the Non-Contact Recreation form) is multiplied by 5 to transform it to a 0-100 scale. This percent cover score represents 10 % of the Aquatic Life Index.

2.6.3.5 Chlorophyll- a Index

This index is calculated by converting the raw data (VSS, pheophytin and Chlorophyll-*a*) to q-values (see "Median Method", pg. 66) and weighting these values. The chlorophyll-*a* is 60% of the final score, while VSS and pheophytin are 20% each of the final score. The indexed q-values for Chlorophyll-*a*, VSS, and pheophytin are shown in Table 12. The index is calculated by taking the percent similarity of VSS and pheophytin to the reference site and averaging these values together. Chlorophyll-*a* values are averaged together with the VSS and pheophytin to include all values but give more weight to the chlorophyll *a*. The final chlorophyll- *a* index value is calculated by taking the site value and multiplying the average by 0.25 so that it makes up 25% of the Aquatic Life Score.

Table 12: Q-Values for Chlorophyll *a* Index

Parameter	INDEX VALUES					Weight
	100	75	50	25	0	
Chlorophyll-a	0.067	0.22	1.4	6.3	141	0.6
Volatile Suspended Solids	0.0	125	939	2696	80000	0.2
Pheophytin	0.067	0.14	0.21	3.9	81	0.2

Note: Pheophytin 0.14 is a linear interpolation since the calculated value = detection limit.

2.6.3.6 Fish presence/absence

This is the simplest metric to calculate. If fish are present at the site, the site score is 100; if fish are not present, the site score is 0. The final fish presence/absence value is calculated by taking the site value and multiplying the average by 0.1, making it the final 10% of the aquatic life score.

2.6.4 Results from Pilot Watersheds

A summary of the results for the aquatic life sub-index during the pilot studies is provided as Table 13.

2.6.5 Pilot Watershed Interpretation

The overall scores for data collected in 1994 ranged from 19-74%. Barton was the least impacted of all the creeks (74%), scoring in the Good category, with Fort Branch, Shoal Creek, and East Bouldin (25%, 22 %, and 19% respectively) scoring in the Bad category. Results for 1995 were similar to those found in 1994. Once again, Barton Creek ranked highest of all the creeks (72%). Fort Branch had the lowest creek score in 1995 (40%), but East Bouldin was not much higher (44%). From highest to lowest scores, the creeks were ordered Barton, Williamson, Shoal, East Bouldin, and Fort Branch. Although Shoal, East Bouldin, and Fort Branch were ranked differently than in 1994, they remained in the Fair category.

Figure 5: Aquatic Life Habitat Field Assessment Form

Date: **Time:** **Site:**

Obersever:

Indicator	Excellent (20-16)	Good (15-11)	Fair (10-6)	Poor (5-1)	Score
Instream Cover	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat.	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat.	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable.	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat is obvious.	**Score:______**
Channel Flow Status (Velocity)	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	**Score:______**
Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble and boulder particles are more than 75% surrounded by fine sediment.	**Score:______**
Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is between ratio >25.	**Score:______**
Anaerobic Conditions	No evidence; healthy exchange of gases.	Minimal; slight evidence under rocks.	Moderate condition; thin layer of film.	Highly anoxic thick black layer of film.	**Score:______**
Riparian Zone Width (Least buffered side)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters, human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone < 6 meters: little or no riparian vegetation due to human activities.	**Score:______**
Percent Filamentous Algae (Give a Pecentage)	Surface less than 10% covered by algae.	Surface 10-20% covered with algae.	Surface 20-30% covered with algae.	Surface more than 30% covered with algae.	**Score:______**
Riparian Vegetative Type	**Description:**				
					Total: ____________

Table 13 Results of Aquatic Biological Subindex for Pilot Watershed 1994 Results

Site	Bugs	Diatoms	Algae	Fish	Chlorophyll-*a*	Weighted Score	Creek	Creek Score
East Bouldin								
EBUpstrea	0	18.69	100.00	0.00		40.65	East Bouldin	19
EBMultiS	0	13.59		0.00		25.09	Barton	74
EBEliz.S	41	9.73	95.00	0.00		32.35	Shoal	22
EBDownSu	0	13.91	100.00	0.00		41.85	Fort Branch	25
Barton Creek								
BCHwy71S	81	81.59	100.00	100.00		88.76		
BCLostCr	69	51.71	100.00	100.00		72.67		
BCpoolSu	70	38.93	78.00	100.00		61.10		
Shoal Creek								
SCUpstrea	0	5.80	100.00	100.00		51.15		
SCUpperM	65	10.64	67.00	0.00		37.46		
SCLowMid	0	27.78	70.00	0.00		39.67		
SCDown	34	16.57	7.00	0.00		20.13		
Fort Branch								
FBUpstrea	0	11.67	82.00	0.00		38.25		
FBUpperM	0	16.72	100.00	0.00		41.24		
FBLowerM	58	5.48	93.00	100.00		49.65		
FBDown	0	9.75	100.00	0.00		35.62		
East Bouldin								
EBUpstrea	44	16.75				31.80	East Bouldin	44
EBMultiS	55	35.74				42.54	Barton	72
EBEliz.S	59	47.32				51.05	Shoal	54
EBDownSu	60	26.84				40.65	Fort Branch	40
Barton Creek							Williamson	54
BCHwy71S	71	84.15				84.52		
BCLostCr	69	59.33				64.11		
BCpoolSu	80	70.52				69.91		
Shoal Creek								
SCUpstrea	69	45.15				52.96		
SCUpperM	70	49.70				56.05		
SCLowMid	52	43.89				42.94		
SCDown	68	21.83				43.79		
Fort Branch								
FBUpstrea	39	27.81				37.14		
FBUpperM	50	20.71				35.76		
FBLowerM	50	31.48				43.62		
FBDown	65	22.60				44.90		
Williamson Creek								
W Upstream	76	46.26				55.63		
W Midstream	76	27.60				49.57		

W Downstream	74	42.32				56.12		
W I-35	61	35.25				45.88		
W Nuckles	67	42.71				52.62		
W Mouth	55	31.26				53.03		

Generally, the site scores within each creek declined from upstream to downstream, as the effects of development are compounded, but there were several exceptions. East Bouldin's score increased slightly at downstream stations for both monitoring periods. The downstream increase may be due to construction that was occurring in the upper part of the watershed at the time of sampling. In addition, less riparian vegetation is present in this upper reach which may have influenced biological parameters. In 1995, Fort Branch and Williamson scores also increased going downstream, however this increase was relatively minor.

Of all the parameters in the aquatic score (macroinvertebrates, diatoms, algae, fish, and chlorophyll *a*) the diatom analysis of the pilot watersheds seemed to establish the most distinction between the site scores. The diatom scores varied between 5.5-84.5, ranging over every category of the EII from Bad to Excellent. The macroinvertebrate scores varied from 34.2-87.0, ranging over three of the four categories, with none of the sites scoring in the Bad category. Although the trends established between the two parameters were similar, the diatom analysis was able to differentiate sites when the macroinvertebrate scores did not. The distinction in scores was also consistent with the level of impairment assumed for the watersheds on the basis of their impervious cover and level of development.

Barton Creek scored in the Good category even though it is notably the least impacted creek of the pilot watersheds. This may be attributed to the low scores at the downstream site, which has a large groundwater influence from Barton Springs. Due to the use of metrics which measure similarity to a relatively unimpaired stream reference site, this groundwater influence may have effected the site scores enough to make it appear to be of lower quality. Moving the downstream site above this groundwater influence, as is planned for future EII studies, may alleviate this problem. Williamson Creek is considered a non-urban watershed and was ranked second below Barton. This result was the expected outcome because of the high degree of development in various portions of the Williamson Creek watershed. East

Bouldin, Shoal, and Fort Branch are all high impervious cover urban streams and the Fair rating they received is also as expected.

Generally, the more impaired watersheds scored lower in the aquatic life category. Barton Creek is the least impaired creek and thus scored the highest. East Bouldin and Fort Branch ranked differently in 1995 than in 1994, but the category of Fair remained the same. These differences in ranking were very slight, and may be attributed to seasonal variation. The aquatic life score developed for the EII was consistent with watershed development and relatively consistent over the two years of pilot watershed studies. Therefore, it continues to be used as an integral part of the EII methodology.

3.0 IMPLEMENTATION OF THE EII

Upon review of the pilot watershed data and concurrent development of the structure for the Watershed Protection Masterplan, it was decided to apply the EII methodology to the eighteen watersheds scheduled for masterplanning during FY 1996-1997. Sampling for sediment was conducted first due to the long laboratory turn-around time anticipated before results would be available. Mouth sediment sampling for each watershed was completed in late September 1996. Additional sediment sampling was completed at future urban and non-urban watersheds to facilitate completion of the EII citywide and optimize City resources. Aquatic life and water quality components were conducted in late November 1996. Completion of field sampling for these components took two weeks. Following this sampling and laboratory analyses, the physical and recreational components were completed in February 1997. Upon completion of taxonomic identification and enumeration for all diatom and benthic macroinvertebrates samples the EII Index score were calculated in May 1997. A six-month internal and external peer review period was completed to solicit comments and make modifications on Environmental Integrity Index methodology in January 1998. Draft copies were distributed to several governmental agencies, consultants, and city staff. After responding to questions and comments received during the review period, addition data mining statistical analysis was completed during 1999 on the EII subcomponents to determine if relationships between EII scores and causative factors such as impervious cover existed. The results and insights from this analysis resulted in minor changes in the EII methodology. The changes made were incorporate in the draft document.

3.1 Site and Sampling Criteria

Since the EII is a triennially monitoring program that is divided into three annual phases, each phase consisting of a group of approximately fifteen watersheds. Site selection and sampling criteria are used to ensure that the data collected is comparable between sampling events. Each year the EII scores will be calculated and monitored. After sufficient time, trends in EII scores will be calculated to determine if watershed is becoming impaired.

3.1.1 Site Selection Criteria

To meaningfully evaluate EII subcomponents, the number of monitoring sites within a watershed are standardized to drainage area watershed size so that the data collected is comparable. Because of the large variation in overall watershed drainage areas, dividing watersheds into smaller equal-size subwatersheds is not possible. Larger watersheds would require numerous too many monitoring sites. Too many to retain the time and cost benefits of using the EII evaluation method. The short timeframe and amount of manpower required to process samples, and financial concerns limits the maximum number of monitoring sites to six. As a result, the size of individual drainage area for a monitoring site increases as the overall watershed size increasedincreases. The following portioning of monitoring sites to drainage area was developed:

Watershed Drainage Area Size (in acres)	Number of Monitoring Sites
<1000	2
1,000 to 3,000	3
3,000 to 9,000	4
9,000 to 15,000	5
15,000 to >27,000	6

The approximate location of purposed sites is determined by using Geographic Information System (GIS) software. Once the watershed's overall drainage area is known and following the drainage area/site number portioning, GIS is used to segment the watershed into equal parts with consideration for public access, usually at road crossings since public access is a limited factor. Field reconnaissance of all purposed monitoring site is preformed to ensure riffles exists at the site, because a riffle areas are required at each site to facilitate benthic macroinvertebrate collections, verify accessibility, assess travel time and ensure that generally comparable habitat exists at each monitoring location. As a result, monitoring sites are influenced by drainage-area size, then available public access, and finally physical habitat constraints.

3.1.2 Selected Sites

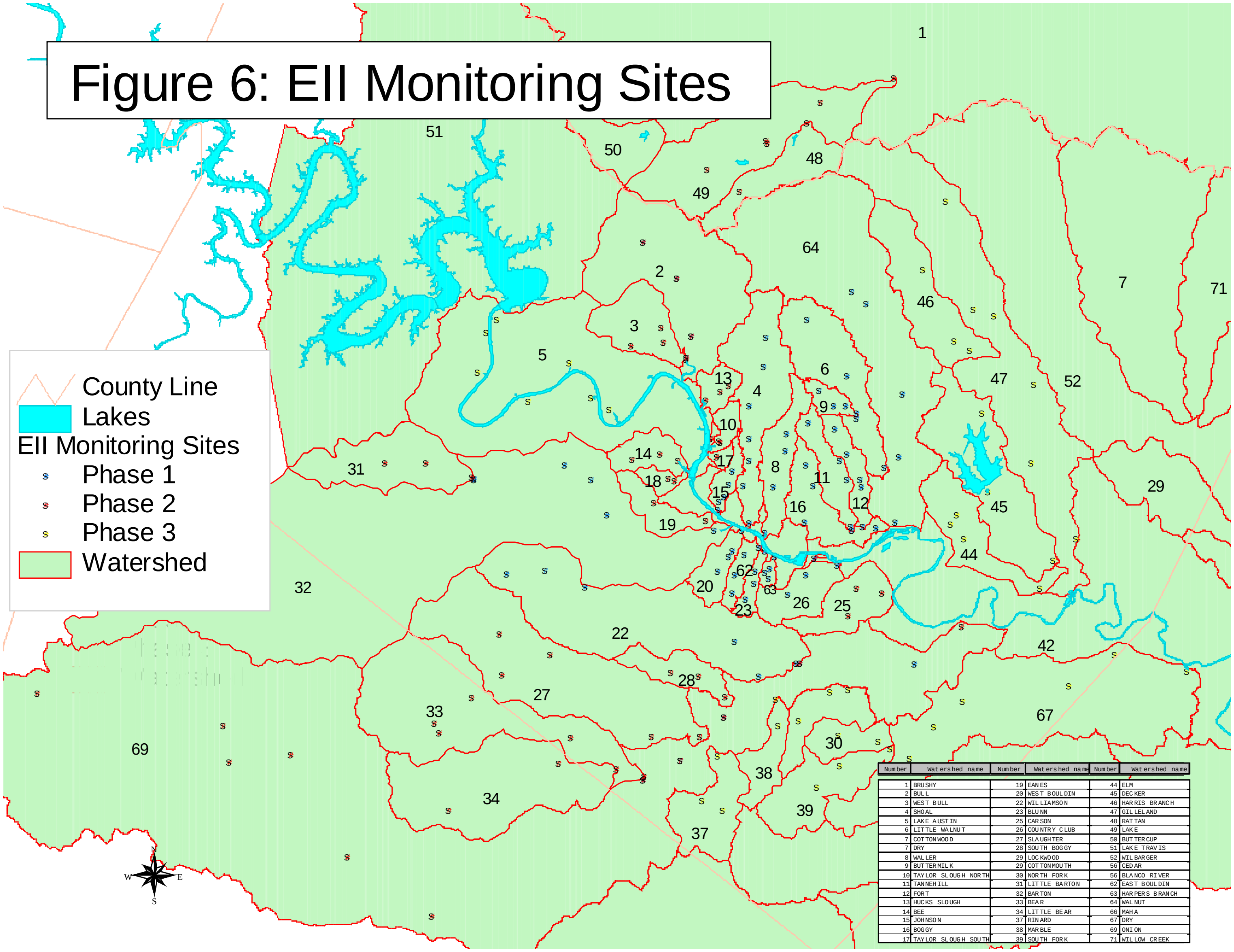
Forty-five of watersheds in Austin’s extraterritorial jurisdiction (ETJ) area are were selected for EII evaluation. The ETJ is the area 5-miles beyond the incorporated territory of the city, in which the city can still impose partial jurisdiction. The forty-five These watersheds have been divided into three groups, monitoring phases I, II and II. of monitoring phases The one hundred and seventy monitoring sites that were selected in the forty-five watersheds selected for Watershed Protection Department’s masterplan evaluation is are listed in Appendix B along with the three monitoring phase groupings.

3.1.3 Sampling Criteria

To ensure that the EII data is comparable between survey periods and to minimize differences in EII scores attributable to seasonal effects, sampling criteria were set established. Since most of the subcomponents use flow-dependent parameters to evaluate Austin’s intermittent creeks, a flow dependent criteria is used to determine when samples are can be collected. The subcomponents that require only one-time sample collection or evaluation: (habitat quality, aquatic life support, sediment quality and noncontact recreation), are sampled within a four-three month window from November December through February. This is the period when sites are more most likely to have the best attainable and most stable flow conditions. Secondly, almost all sites must should have flow for at least three months so that a well-established benthic macroinvertebratebiological community is present. Finally, all samples must be collected during baseflow conditions, which is defined as no rain three days prior to collecting samples. The stringent baseflow criterion is needed because of the large variation in land-use and in the amounts of imperious cover between watersheds. Since the amount and frequency of runoff increases with the amount of impervious cover, smaller precipitation events have a greater influence on a creek’s flow in urban watershed then in a nonurban watershed. Because of the large number of sites and cost associate with collecting instantaneous flow measures, sSeparating baseflow from storm flow by using a long term hydrology data and hydrographs is not financial feasible for all of Austin's watersheds, therefore, the baseflow criterion is based on rainfall, not the changes in the rate of flow. The

City of Austin's Flood Early Weaning System (FEWS) and U S Geological Survey's rain gauges are used to monitor precipitation amounts.

Figure 6: EII Monitoring Sites



Number	Watershed name	Number	Watershed name	Number	Watershed name
1	BRUSHY	19	EANES	44	ELM
2	BULL	20	WEST BOULDIN	45	DECKER
3	WEST BULL	22	WILLIAMSON	46	HARRIS BRANCH
4	SHOAL	23	BLUNN	47	GILLELAND
5	LAKE AUSTIN	25	CARSON	48	RATTAN
6	LITTLE WALNUT	26	COUNTRY CLUB	49	LAKE
7	COTTONWOOD	27	SLAUGHTER	50	BUTTERCUP
7	DRY	28	SOUTH BOGGY	51	LAKE TRAVIS
8	WALLER	29	LOCKWOOD	52	WILBARGER
9	BUTTERMILK	29	COTTONMOUTH	56	CEDAR
10	TAYLOR SLOUGH NORTH	30	NORTH FORK	56	BLANCO RIVER
11	TANNEHILL	31	LITTLE BARTON	62	EAST BOULDIN
12	FORT	32	BARTON	63	HARPERS BRANCH
13	HUCKS SLOUGH	33	BEAR	64	WALNUT
14	BEE	34	LITTLE BEAR	66	MAHA
15	JOHNSON	37	RINARD	67	DRY
16	BOGGY	38	MARBLE	69	ONION
17	TAYLOR SLOUGH SOUTH	39	SOUTH FORK	71	WILLOW CREEK

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions from Literature Review

The following conclusions were developed from literature review and comparisons of with other similar water quality indices investigated:

- Index uses are primarily for resource allocation, ranking of locations, enforcement of standards, trend analysis, public information, and scientific research. The EII is easily applicable for use in each of these areas by the Watershed Protection Department.
- From comparison of the indices evaluated it can be seen that many similarities exist in the basic structure and components of these methods. The major differences appear to be in focus area that dictates the intensity of one component as compared to another.
- Very few of the indices used sediment sampling as a cumulative measure of impact as a sink of pollutants, and the number of chemical parameters for water column samples varies significantly over the indices evaluated.
- All of the currently employed utilized indices employed a well developed physical and biological components whereas previous indices referenced by these studies focused more on the chemical water quality measurements.
- None of the indices investigated appeared to have been organized around a beneficial use framework consistent with the development of the Clean Water Act mandated Water Quality Standards. One exception was noted in the TNRCC assessment method for unclassified waterbodies.
- Finally, implementation of most of the indices was for regional assessment rather than drainage department planning. However, one index employed in Maryland (RSAT) included a prioritization and planning program which closely resembles the planned use of the EII in the masterplanning process as a method to prioritize areas for water quality controls implemented by the City of Austin Watershed Protection.
- Components of various indices are relatively consistent in coverage of physical, biological, and chemical quality of waterbodies; however, In the indices evaluated, recreational components (public health and/or aesthetics) are often neglected or addressed

indirectly by other parameters (We just said above that the physical/biological components were missing in other indices evaluated).

- An organization based on beneficial uses of waterbodies was suggested when applied for application by a resource protection agency in a planning format. In organizing evaluation and protection of specific uses and in direction relation response to the clear mandate for such protections under the Clean Water Act.

4.2 Conclusions from Committee Development and Pilot Watersheds

The following conclusions were developed from results of the initial analysis performed by the service improvement committees developing the EII, pilot watershed investigations applying the EII methodology, and subsequent modifications by the DUMP water quality and coordinating committees: masterplanning committees:

- Although rationale exists for obtaining separate ecoregion specific reference sites for many of the proposed EII parameters, statistical analysis of TNRCC data for least disturbed streams indicates that no significant difference exists between ecoregions for almost all of the water quality parameters of interest to the Watershed Protection Department.

- Because similar statistical comparisons for ecoregion biological data are were not available, the most conservative approach would be to determine reference sites were identified for the Blackland Prairie and Edwards Plateau ecoregions in for the calculation of aquatic life subcomponents. Reference conditions for Edwards Plateau ecoregion sites are represented well by the Barton Creek at SH 71 site. Reference conditions for Blackland Prairie ecoregion sites are represented by the Walnut at Springdale.

- Sediment quality effects levels availability dictated the application of this method to a small group of PAH's and metals for which there was documentationdata has been documented. Additional studies of these effects levels may allow a wider range of parameters to be added at a later date.

- A sediment agitation test applied in the initial runs of the pilot watersheds was dropped in order to increase speed of sampling and reduce the parameters to those generated from methods documented independently in technical literature. Similarly, a transect measurement method for filamentous algae percent cover was dropped in favor of a visual estimate in order to save time.

- Habitat quality parameters specifically relating to aquatic life support were appropriate to track as nonscoring parameters where they were also applied in the habitat quality subindex.
- From the results obtained during the pilot study, the list of scoring metrics for diatom community structure was reduced to percent similarity and the pollution tolerance index. The remaining three parameters metrics investigated did not provide sufficient variation across pilot watersheds to yield a good indicator of community integrity. This index was the most experimental of those proposed; therefore, more freedom in modification was warranted.
- Bias in visual recreational/aesthetic parameters was reduced by both pre-survey training and calibration and post survey quality assurance replication at 10% of all sites.by redundant evaluations by two trained investigators at each site.
- The Oil/foam parameters were was dropped from the initial Non-Contact Recreation parameter list as a result of pilot data indicating redundant coverage by the surface appearance parameter and the potential for naturally occurring sheens to interfere with scoring.
- Filamentous algae percent cover was added to the Non-Contact Recreation subindex recreational score to distinguish between clarity problems caused by inorganic pollutants and problems with appearance related to nutrient enrichment levels.
- Physical measurements of cross section, while valuable benchmarks in assessing habitat quality, are not conducive to index development, without historical data.
- Although applied in initial pilot watershed evaluations, greenbelt/buffer and trail access scores were moved changed to nonscoring parameters due to a perceived bias in the data and the desires of DUMP Watershed Protection committee members to distinguish between ancillary recreational goals of the department and suitability of a site for

recreation as a result of water quality degradation. (I don't really understand what this means??? You could can it if you don't know either.)

- A minimum organism count of 50 benthic macroinvertebrates organisms was found to be necessary before a valid calculation of the benthic macroinvertebrate metrics was could be done. Samples with less than 50 organisms were given a zero score for that portion of the Aquatic Life subindex.
- Incorporating Stream Stability into Habitat quality allows for a more comprehensive evaluation of the conditions affecting beneficial uses.

4.3 Recommendations for Implementation in the Masterplan

Although the development of the index is complete, a significant amount of work is still required for application of the index in the masterplan prioritization scheme process. At this time, the following uses of for the EII in the masterplanning are noted have been identified:

- The EII is used to rank the sub-watersheds, reaches, and creeks by using the current level of problems or impairment in order to help prioritize and plan more detailed investigations which will then yield recommendations for program focus or capital projects for water quality improvement.
- The EII will be used to gauge performance of the Watershed Protection water quality programs by providing an independent assessment and summary performance measure of current water quality status.
- After several iterations of EII data are taken at intervals of 3-5 years, trends in water quality may be tracked to determine rate of degradation or rate of improvement measures for long term planning activities.
- By analyzing subcomponents, the source of pollutants may be narrowed to select types of BMPs most suitable in sub-watersheds or reaches for addressing specific source problems.
- By correlation with a companion project for calculating pollutant loading for the subject watersheds, the EII may be used to predict changes in uses resulting from various

development, ordinance, and BMP scenarios to a degree consistent with long range planning.

4.4 Recommendations from Agency Review of the EII Methodology.

External peer review comments were solicited on the Environmental Integrity Index methodology from several governmental agencies, consultants, and city staff. In general, many of the comments received commended City staff on a "very thorough and well thought out development of the index" as well as identifying areas in the text when clarification was need. Comments and concerns about the methodology that were submitted are addressed below:

- Comments directed at the Habitat Quality Index suggested that the data be normalized to maximum regional reference conditions. The Habitat Quality Index is not a habitat assessment, although it uses several parameters from the EPA's Habitat Quality Index (Barbur, 1993). The ranges for the Habitat Quality Index should not be relative to reference conditions, because the ranges of each category (excellent – very bad) indicate a value that describes a physical condition. In practice, there would be no changes in the distributions of scores in this index if they were normalized since several sites scored about above the 90th percentile. In order to interpret aquatic life scores with habitat scores, the nonscoring aquatic life habitat data should be used and could were normalized to reflect regional best attainable conditions. In future surveys (later than 1998), the Habitat Quality Index will be normalized to a local, best attainable, reference condition.
- Another concern was use of the 1975 USDA stream stability assessment form. This form is intended to address stream stability, not habitat quality. This is a common method used by the US Forest Service, US Army Corp of Engineers, and many hydrologists to visually assess stream stability. Although some of the parameters may appear to be inappropriate for this region and more suited for evaluating mountain streams, in this application, maintaining the integrity of the original method outweighed the benefit of small changes for local adaptation.

- The importance of assessing the flow conditions at each sample site was a concern. We agree with the importance of documenting the flow and staff has taken flow measurements at every monitoring site, however qualitatively incorporating the flow information into the index is difficult. Staff is continues exploring the incorporation of flow incorporating flow into the water quality or habitat quality subcomponents.
- Data analysis comments suggested conducting some multivariate and cluster analysis on the biological communities along with environmental factors to determine if some of the subcomponent scores could be adjusted. Exploratory data analysis and data mining on the raw EII data, such as the benthic macroinvertebrate community data, has not been completed. Staff has analyzed macroinvertebrate community structure versus different hydrologic conditions. No relationships were found, but the analysis will continue as more data. Our goal is to complete our analysis by the beginning of phase two of the masterplan. Multiple regression analysis of EII subcomponent scores versus causative factors was performed. Results indicated that the overall EII scores and subcomponent scores, with exception of the sediment quality score, were significantly correlated to impervious cover. Degradation, defined when the EII score changed from “excellent” to “good” or good levels, began at impervious cover levels of 5 to 15%. Other researchers, such as Robert Schueler (Schueler, 1996) and Earl Shaver (Shaver, 1996), have also documented an impact-impervious cover relationship. In addition, EII subcomponents were correlated to a ratio of baseflow volume/rainfall volume, a ratio of stormflow volume/rainfall volume, and to nutrients.
- The small size of the data set used for determining water chemistry differences between ecoregions is a concern. In addition, a median test might be better suited for the data, although not as statistically powerful as ANOVA. As mentioned in the report, staff was concerned with the size of the data set, however, all the available data was used. In the future if more data becomes available, the analysis will be repeated to verify the ANOVA results. The data was re-analyzed using the median test and the results were the same as the ANOVA results.

- It was suggested that the changing weighting for the different components of the EII be changed to be more relevant to the citizens of Austin who may be more concerned with aesthetics and contact recreation. The determination of component weighting was driven by the needs of the masterplan to assess the environmental integrity of a watershed. It was the opinion of City staff that each of the six components were equally important in determining a creek's environmental integrity index score, and that any additional weighting of component scores should occur at the masterplan level.
- In the aquatic life component there is a concern that algae percent cover and chlorophyll-α overlap somewhat on what they are assessing, and for purposes of directly addressing citizens concerns, perhaps algae percent cover should receive more weight, with less given to chlorophyll-α. Although the amount of chlorophyll- α in a waterbody might be less of a concern to the citizens of Austin, it is a more quantitative measurement of alga biomass then the subjective evaluation of percent algae cover on the habitat assessment sheet. City staff maintains, in this case, believes that the more quantitative measure should receive more weight.

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Appendix A - Literature Review

Common Factors in Environmental Indices

Environmental indices have been developed since the beginning of the Clean Water Act era to assist in formulating policy, providing a means for judging environmental protection programs, assisting in designating programs, and facilitating communication with the public. In general, the purposes of development and use of environmental indices include.

- Resource Allocation
- Ranking of Locations
- Enforcement of Standards
- Trend Analysis
- Public Information
- Scientific Research

One rationale for developing comprehensive water quality indices such as the EII was provided in a 1995 by Davis and Simon as follows:

> We waste money and degrade resources because decisions based on chemical criteria do not adequately protect water quality; priority lists of chemicals do not accurately reflect ecological risks: point-source approaches do not effectively control the influence of nonpoint sources or the cumulative effects of numerous contaminants: and finally, the chemical-contaminant approach fails to diagnose water resource problems caused by other human influences. Degradation begins in upland areas of a watershed or catchment as a result of human actions that alter the plant cover of the land surface. These changes, combined with alteration of stream corridors, alters the quality of water delivered to the stream channel as well as the structure and dynamics of those channels and their adjacent riparian environments. The cumulative effects of these degrade water resources… with potentially devastating and often undetected effects on water quality (Davis and Simon, 1995)".

The statement above addresses the common goal of environmental indices: to accurately and comprehensively depict the current state of the as well as the history that led up to it.. In particular, water quality indices must consider the cumulative effects of diffuse sources of degradation that often go undetected using conventional water quality parameters. (Ott, 1983)

In the literature investigated, five primary classes of variables are proposed as necessary to water quality indices as follows (Davis and Simon, 1995):

- Habitat structure (substrate type, water depth, and current velocity, spatial and temporal complexity of physical habitat)
- Flow regime (water volume, temporal distribution of flows)
- Energy source (type, amount, and particle size of organic material entering stream, seasonal pattern of energy availability)
- Biotic interactions (competition, predation, disease, parasitism, mutualism)
- Water quality (temperature, turbidity, dissolved oxygen, acidity, alkalinity, organic and inorganic chemicals, heavy metals, toxic substances)

Most of these variables are routinely assessed in categorizing habitats for aquatic life uses (bioassessments). To these variables, one must add those specifically designed to reflect human uses for the environment. These include health concerns, recreational quality, and aesthetics. The EII is an attempt at combining these needs into a single, accessible measure of the state of watersheds for use in planning and prioritizing expenditures of Watershed Protection funds.

One purpose of this documentation is to put the proposed Environmental Integrity Index in context of the literature available on environmental indices. A second purpose is to document the methodology of the index for peer review and public comment. For these reasons, a literature review of indices implemented in similar regulatory and planning contexts is provided. In particular, the US Environmental Protection Agency (USEPA) Rapid Bioassessment Protocols (Plafkin, et al. 1989) and the Texas Natural Resource Conservation Commission, (TNRCC) Use Attainability Assessment and Physical Characteristic Assessment (TNRCC, 1988) were the most useful references reviewed. The EII methodology incorporates many of the procedures described in these references; however, some of the procedures are new or modified to better reflect the central Texas ecoregions and local hydrologic conditions.

Current Monitoring Programs

Under the directive of the Clean Water Act "to restore and maintain the chemical, physical and biological integrity of the Nation's waters," water resource managers from various agencies throughout the nation developed methods to assess the integrity of our nations' waters (Clean Water Act, 1972).

Until recently, the majority of water resource programs focused on water chemistry as a barometer of water quality, neglecting its life supporting biological and habitat quality. However, the monitoring programs initiated in the past three years appear to have taken a more holistic approach. The following is a review of comparable federal, regional, and state agency programs that are currently being used to assess the integrity of water resources.

U. S. Geological Survey Water Quality Assessment Program

The US Geological Survey (USGS) National Water-Quality Assessment Program (NAWQA) is designed to assess the current status of the Nation's waters and examine water quality trends in order to gain an understanding of critical factors which affect water quality and observed trends (USGS, 1993). The protocols include chemical, physical, and biological assessments at fixed sites representative of a broad range of conditions (natural and human impacts) which are believed to affect water quality. These natural and human conditions include factors such as "ecoregions, land use, stream size, hydrology, and geology"(USGS, 1993). The NAWQA assessment for streams and rivers is comprehensive and includes sampling data on the following:

- Hydrology
- Chemical constituents and moving organic contaminants (major ions, trace elements, and nutrients)
- Physical measurements (suspended sediment, conductance, temperature, radionuclides, and organic contaminants in water)

- Trace elements and organic contaminants in bed material and aquatic biota
- Ecological information (fish, benthic invertebrate, and algal communities)
- Stream habitat evaluation (USGS, 1993).

The stream evaluation has both temporal and spatial components and is viewed within the context of multiple spatial scales (i.e., watershed and landscape scales). Retrospective analyses are included to provide context to the water quality and biological conditions observed. Reconnaissance analyses are conducted to rapidly collect watershed feature data and evaluate stream access, habitat conditions, proximity to major influences, and appropriate sampling methods and equipment for multiple potential sites. Occurrence and distribution assessments are conducted to characterize geographic and seasonal distributions of water quality conditions. The sampling design also includes assessment of long term trends and changes in selected water quality characteristics. In addition, source, transport, fate, and affects studies are conducted as part of NAWQA to test hypotheses and examine causes of water quality degradation. These studies are targeted at high priority national waters whereas the remaining analyses represent the nation's waters as a whole (this sentence is unclear, which studies are for high-priority waters and which studies are for the "nations water as a whole"? What is the difference between the work that goes on at the two levels?).

Sampling is conducted on a schedule which targets one region intensively for 4-5 years followed by a period of less intensive routine data collection for the next 5 years. This sampling design was devised to obtain the coverage and depth of data on each of 60 study units (basins or aquifers) with approximately one third in intensive study at any time. Sampling is conducted at basic fixed sites at which a broad spectrum of chemical and biological parameters are measured as well as flow and synoptic sites at which one-time collection of a subset of parameters may be performed to answer specific questions about the unit under study.

The physical habitat assessment is conducted at various spatial scales including: 1) the basin, 2) the segment, and 3) the reach. A "basin" refers to "the area drained by all surface waters located upstream of a selected site (USGS, 1993). The basin assessment is taken from GIS databases and maps. This evaluation consists of a characterization of such spatial factors as physiographic province, geology, and climate. A stream segment is defined as that part of a stream bounded by tributary junctions or discontinuities, such as major waterfalls, landform features, significant changes in gradient, or point-source discharges.

The stream segment characterization is conducted at fixed sites using USGS 7.5-quadrangle maps and aerial photographs. The information collected for each site includes a complete description of location, segment length, elevation, sideslope gradient, segment gradient, channel sinuosity, stream order classification, and the downstream link (the magnitude of the link of the next downstream confluence).

The stream reach, as defined by two repetitions of geomorphic channel units (riffle, run, and pool), is the principle sampling unit for the USGS NAWQA assessments. Three reaches are typically defined for each basic fixed site, and longitudinal limits are specified for reaches based on stream channel width and depth. Four to six basic sites in a basin are sampled for intensive periods annually, and typically only one reach is measured at each site. However, an initial baseline survey requires sampling at all reaches to be completed in one year.

The habitat assessment is based on two levels of reach characterization and both levels are accomplished through field sampling of specific parameters. The first level assessment consists of a comprehensive collection of location data based on six transects taken perpendicular to stream flow. The data include:

Parameter Type		Parameter Type	
1	Reach conditions	13	Canopy angle
2	Channel width at reach boundary	14	Aspects of downstream flow

3	Geomorphic channel units	15	Habitat features
4	Reach length	16	Bar/shelf/island
5	Stream type	17	Bank angle
6	Channel width	18	Bank height
7	Bank width	19	Bank vegetation
8	Floodplain width	20	Bank slope
9	Water depth	21	Bank erosion
10	Stream velocity	22	Bank substrate
11	Bed substrate	23	Bank wood/vegetation
12	Embeddedness	24	Aquatic and riparian vegetation species

The second-level reach assessment is a detailed characterization of reach geomorphic and hydraulic characteristics designed to provide additional quantitative data. This survey includes longitudinal profiles of the water surface, floodplain, and channel bed; cross-sectional surveys using levels (minimum of three per reach); a map of the reach; and a quantitative analysis of bed and bank materials.

Fish sampling at basic fixed sites is performed through multiple methods of collection (electrofishing, seining, gill netting, hoop netting, snorkeling, and/or trawling) to maximize the representation of the community as a whole. Sampling of biota is conducted during low and stable flow periods in essentially perennial streams at least four weeks following a flood with a recurrence interval greater than 5 years.

The alga component of sampling provides a characterization of species and community structure of periphyton (benthic algae) from composited samples of each microhabitat within a stream reach. Qualitative multi-habitat sampling is performed to develop a comprehensive taxon list for the reach at the time of sampling. Quantitative periphyton samples, chlorophyll *a*, and ash free dry mass are taken from natural substrates qualified as richest-targeted habitat (RTH) and depositional-targeted habitat (DTH) instream habitat types. Microhabitats vary by submerged substrate including epilithic (rock), epidendritic (roots/branches), epiphytic (plants), epipelic (fine sediment), and epipsammic (coarse sediment). Sampling methods vary for each microhabitat. Macroalgae, microalgae, and aquatic mosses are sampled. Periphyton data are related to water quality and habitat data at each site to note taxon-specific responses to changes in water and sediment chemistry, to determine the effect of algae communities on water quality, and to integrate physical, chemical, and biological data in the assessment. Phytoplankton samples are also taken from water column locations at the periphyton sample sites.

Similar to the periphyton methodology, benthic macroinvertebrates are sampled from each instream habitat type found in a reach at a basic fixed site. For invertebrates, a matrix of geomorphic and channel characteristics is used to define 51 habitat types which determine whether qualitative or semiquantitative samples are collected and what collection methods are used. As with periphyton, RTH and DTH habitat types are sampled. Typically RTH's have coarser sediment and higher velocities than DTH's. Spatial variability is evaluated by sampling all reaches during one year and temporal variability is evaluated by sampling one reach at each site once per year during a NAWQA program cycle. Sites are chosen to indicate the sources of variability in the study unit including reference conditions, heavily impacted sites, major land uses, and major physiographic areas in the unit.

Chemical water quality and field water quality data are also taken at each basic site during benthic macroinvertebrate and periphyton sampling. Field parameters include continuous flow records, temperature, and pH. Water chemistry includes nutrients, metals, and organic compounds. Sediment and fish tissue samples are also taken and a variety of chemical analyses are conducted on these samples. Chlorinated organics, polycyclic aromatic hydrocarbons, and major metals and trace elements are analyzed for these samples.

US Environmental Protection Agency Rapid Bioassessment Protocols

The US Environmental Protection Agency developed the *Rapid Bioassessment Protocols (RBP) for Use in Streams and Rivers* as the standard technical reference for methods of biological evaluation and characterization of freshwater lotic systems. However, the RBP can be used for a wide range of planning and management purposes including 1) characterizing the existence and severity of impairment; 2) identifying sources and causes of impairment; 3) evaluating point and non-point-source pollution; 4) evaluating the effectiveness of control actions; 5) priority setting; 6) use attainability analyses; and 7) trend monitoring (USEPA, 1989).

In the RBP guidance, five protocols are outlined including three levels of benthic macroinvertebrate analysis (RBP I, II, III) and two levels of fish analysis (RBP IV, V). All levels include semi-quantitative site and habitat documentation. A basic premise of the RBP's is that a site can be compared to a reference site to determine the level of impairment using a variety of biological indicators and metrics obtained from benthic macroinvertebrates and fish sampling and taxonomic breakdown. The USEPA recommends RBP protocols for detecting and assessing the severity of aquatic ecosystem degradation. However, chemical analysis is recommended to determine the causal agent and to plan remediation. Moreover, in the RBP guidance, EPA suggests that all successful water quality monitoring programs require integrated methods of biological, chemical, and physical assessments.

Water Quality Assessment

The water quality assessment is based on conditions known to significantly affect the aquatic community. These include conventional water quality parameters such as temperature, dissolved oxygen, pH, conductivity, stream type, turbidity, and the presence of water odors and surface oils. Very little definition is given to the water quality assessment performed as part of the RBP's because they are typically part of a larger monitoring program such as the inventory of waterbodies used in the Clean Water Act Section 305(b) status report.

Habitat Quality Assessment

The habitat quality assessment is a comprehensive evaluation of the entire riparian zone including the stream channel and the floodplain. The evaluation is divided into three categories: primary, secondary, and tertiary parameters. Primary parameters are those that characterize the immediate aquatic habitat and have the greatest direct impact on the aquatic community. Parameters of this type include characterization of the bottom substrate and available cover, and estimations of embeddedness, flow velocity, and depth. Secondary parameters target habitat evaluation at a larger scale and include channel morphology characteristics. These indicators include channel alteration, bottom-scouring and sediment deposition, and stream sinuosity. The tertiary parameters assess streambank structure and the riparian vegetation. Tertiary parameters include; bank stability, bank vegetation, and streamside cover (USEPA, 1989).

The habitat quality index uses four categories (Optimal, suboptimal, marginal and poor) and a scale of 1-20 points, with a five-point range for each category. Narrative descriptions of each category are provided on a detailed field sheet which is completed by trained and calibrated field staff. Scores for each evaluation site are then totaled and compared to a control site (i.e., a reference condition based on the "best attainable" situation for a stream of similar size and type as the study stream). A ratio is then calculated giving a final habitat score relative to the stream's potential.

Biological Assessment

A quantitative sampling of the major benthic macroinvertebrates is conducted and supplemented by sampling of other aquatic biota (i.e., periphyton, macrophytes, slimes and fish) when available. Sampling is accomplished by using a dip net or kick net or by hand. RBP I requires only qualitative evaluation of these field samplings. RBP II requires a quantitative evaluation using eight primary ecological indicators or metrics calculated at the family level from taxonomic classification and enumeration performed in the field. RBP III requires samples to be preserved and returned to the laboratory for identification to genus or species level, and calculation of the following metrics:

- Taxa richness
- Family (II) or species (III) based biotic index
- Ratio of intolerant to tolerant taxa (EPT/Chironomid abundances)
- Ratio of functional feeding groups (scrapers/filtering collectors)
- Percent contribution of dominant taxon,
- pollution sensitive taxa (EPT)
- Community similarity index
- Ratio of Shredders to total species

RBP IV and V are similar methods for fish communities, and are applicable to productive perennial streams, which are uncommon in the Austin metropolitan area.
(I think this whole section is uneccessary. There is no real distinction between the RBP habitat stuff and this update of the Habitat Quality Index) Barbour and Stribling Technique For Assessing Stream Habitat Structure

USEPA Environmental Monitoring and Assessment Program (EMAP)

The USEPA developed the Environmental Monitoring and Assessment Program (EMAP) for national surface waters and conducted a pilot study in Region 3.   Ultimately, the EMAP program is designed to determine the current status, changes, extent of changes, and trends in the condition of all our nation's ecological resources on regional and national scales (USEPA, 1994).   The primary goal of EMAP is to provide environmental decision-makers with statistically valid interpretive reports describing the health of our nation's ecosystems (USEPA, 1994).   The procedure for the surface water monitoring protocol is contained in the *1994 Pilot Field Operations and Methods Manual for Streams.* The program uses a probability based sampling design to maximize the statistical rigor of the data and allow the generalization of results to similar stream systems.   A survey approach is taken to maximize the spatial coverage of sample reaches within a two month sampling window with less emphasis on intensive sampling over time.   One fourth of sites are sampled within each region each year using a randomized systematic selection from several different strata of streams.   This results in a spatially balanced sample spread evenly across a range of stream sizes. Unlike other water quality evaluation and monitoring protocols, this assessment is quantitative in nature and includes chemical, physical, and biological components.

The EMAP water chemistry assessment procedure is based on quantifiable, reproducible parameters describing the chemical characteristics of streams that affect aquatic biota. A quantitative chemical water analysis is critical to the diagnosis of impairment, in determining the causal agent, and in tracking trends. The comprehensive water analysis includes levels of major cations and anions, pH, temperature, dissolved oxygen, dissolved inorganic carbon, nutrients, total iron, total manganese, total aluminum, turbidity, and color. Additional parameters may be selected in order to determine the acid-base status, trophic conditions, specific chemical stressors, and classification of water chemistry type. Therefore, the protocols employed are not strictly consistent between watersheds.

The EMAP uses seven general physical habitat characteristics known to be important to stream ecology. These seven attributes are: channel dimension, channel gradient, channel substrate size and type, habitat complexity and cover, riparian vegetation cover and structure, anthropogenic alterations, and channel-riparian interaction. It is noted in the EMAP procedure that habitat characteristics vary as a result of both natural and anthropogenic alterations. Physical habitat characteristics tend to vary naturally with stream size (drainage area) and overall gradient. Therefore, physical habitat field measurements are analyzed in context with water chemistry, temperature, and other available data such as land use and land cover data for each particular stream.

The physical habitat protocol of EMAP is composed of four basic procedures: 1) the thalweg profile, 2) a woody debris tally, 3) channel and riparian cross-sections (11 cross-section stations at equal intervals along the reach), and 4) a discharge measurement. The thalweg profile is a longitudinal analysis of stream depth, width, habitat class, and presence of fine/soft sediment at 100 equally spaced points along the centerline of the stream reach. The woody debris tally is a continuous survey of the large woody debris present along the stream reach. Channel and riparian cross-sectional analysis consists of a detailed cross-section through the channel and riparian zone adjacent to the channel. The cross-sections include measures and/or visual estimates of channel cross-sectional dimensions, substrate, fish cover, bank characteristics, and riparian vegetation structure along the length of the reach at 11 equally spaced stations. The USEPA notes their specific cross-sectional habitat parameters as follows:

Measurements: Channel cross-section dimensions; bank height; undercut; angle (with rod and clinometer); gradient (clinometer); sinuosity (compass backsite); riparian canopy cover (densiometer).

Visual Estimate: Substrate size class and embeddedness; areal cover class and type (i.e. woody) of riparian vegetation in canopy; mid-layer and ground cover, areal cover class of fish concealment features, aquatic macrophytes and filamentous algae.

Observations: Human disturbances and their proximity to the channel.

The final component, discharge, is a measure of water depth and velocity at 15-20 equally spaced intervals taken along one cross-section. Discharge is measured with an electromagnetic or impeller-type flow meter in medium to large streams. In very small streams, a portable weir can be used to measure discharge or discharge can be measured by recording the time required to fill a bucket of known volume.

USDA Forestry Service Methods for Evaluating Stream, Riverine Systems

The USDA Forestry Service developed *Methods for Evaluating Stream, Riparian, and Biotic Conditions* (Platts et al., 1983) to standardize the assessment of physical and biological parameters of habitat quality and to describe strengths and weaknesses of selected indicators used in assessing aquatic habitat. Additionally, this document sought to improve accuracy in describing the quality of the aquatic ecosystem by providing measurable parameters which best reflect habitat quality.

In assessing the condition of the stream habitat, the USDA Forestry Service recommends using a transect system for evaluation. The use of transects allows repeated measurements over time at exactly the same location. However, Platts and others caution that single transects do not provide an accurate assessment of an entire stream or an individual reach. The USDA Forestry Service recommends the stratified random station design to be the best transect method when there is reliable information available regarding the monitoring stream. This design allows extensive evaluation in complex areas and less evaluation in homogenous areas. In this document stream habitat evaluation is subdivided into four categories; the water column, channel morphology, streambank, and stream bottom. The water column or water substrate is evaluated on its suitability for supporting aquatic life using the following parameters: stream width, stream depth, stream shore water depth, pool, pool quality, pool feature, riffle, glide, run, pocket water, pool-riffle ratio, stream flow, and solar radiation.

Channel cross-sections are made using the generalized sag tape procedure (Platts et al., 1983). Channel cross-sectional analysis provides a permanent record of channel morphology at a particular point in time. Cross-sectional analysis, when conducted over a period of time, is useful in tracking trends in channel bank and bed erosion and deposition. Additionally, it is suggested that plotted cross-sections are useful in estimating hypothetical flow rates.

Important indicators for evaluating the streambank include soil alteration, vegetative stability, bank undercut, and stream channel-bank angle. It is suggested that the stream bottom evaluation be conducted in periods of low flow if assessments are infrequent. Important characteristics for evaluating the condition of the stream bottom include channel elevation, channel gradient, channel sinuosity, stream channel substrate, sedimentation, erosion and deposition, and stream order. This study emphasizes the importance of an evaluation of the riparian zone since land use can affect stream habitat. Important indicators of the condition of the riparian zone are stream side cover, vegetation with the floodplain, vegetation overhanging the channel and habitat type (characterization of the dominant and subdominant stream side material [organic or inorganic]).

Oklahoma Water Quality Assessment

The Oklahoma Water Resources Board and the Oklahoma Conservation Commission developed a standard operating procedure for stream habitat assessment. The assessment includes both instream parameters and parameters related to the riparian zone. The assessments begin with spatial and background documentation of the stream and the assessment procedure. The evaluation includes seventeen total parameters, with eleven of the parameters ranked along a continuum of habitat conditions from excellent to bad. The remaining parameters (flow rate, channel sinuosity, water depth, width of water and width of bank, average height of the eroding banks, average percent slope, and average width of the natural riparian vegetation) are directly measured. The specific parameters are channel flow rate, channel sinuosity, water depth width, width of stream and width of bank, substrate type, habitat type, instream cover area, embeddedness, percent canopy cover, point bar formation, deposition and scouring, bank vegetative cover, dominant vegetation, average percent streambank erosion, average height of the eroding banks, typical substrate of each bank, and average width of the natural riparian vegetation. Additionally, land use information (i.e., the presence of cattle, etc.) and any other pertinent information is recorded.

Ohio Environmental Protection Agency Surface Water Assessment

The Ohio Environmental Protection Agency (Ohio EPA) provides support for all agency surface water programs. The agency conducts an annual water quality survey for all state surface waters. In an effort to reach the primary biological goal of the Clean Water Act (CWA) or the Water Quality Act (WQA), the Ohio EPA has adopted an integrated approach to surface water quality monitoring that incorporates chemical, physical, and biological components. The Ohio water quality management program considers site specific characteristics of the receiving water body as opposed to an "end of the pipe" regulatory approach used in the past. This biological and water quality survey program has now been in effect over 15 years and has provided invaluable insight into the value of a broad based holistic approach as well as the importance of using biological criteria in water quality management. The Ohio EPA supports bioassessment because they believe that the resident biota of any surface water body represents "the integrated result of many chemical, physical, and biological processes over time." Thus the existing biological condition is the 'summation', or result, of these processes in their dynamic sequences. Biological communities themselves are noted as precise indicators of actual conditions since they inhabit the receiving waters continuously and are subject to the variety of chemical and physical influences that occur over time (Ohio EPA,1988). When biological measures are used in conjunction with the other assessment tools they enhance the ability to identify and quantify impacts in the aquatic ecosystem.

The Ohio EPA survey is an integrated assessment consisting of "chemical measures (water column, effluent, sediments, tissues), physical measures (hydrological/morphological, habitat), and biological measures (fish and invertebrates) (USGS, 1994)."   Physical measurements, with the exception of flow, are included in the habitat evaluation. The Qualitative Habitat Evaluation Index (QHEI) is an index of macro-habitat quality designed to correspond to physical factors that affect fish communities and macro-invertebrates. The index is designed to provide a time efficient method of field assessment, to take advantage of the experience of staff biologists, to include important variables that may influence fish communities, to provide reproducible assessment results between field surveyors, to separate the effects of habitat from water quality on fish communities and to establish a baseline community for a particular habitat. The index includes the following six metrics:

- Substrate type and quality (silt covering and embeddedness)
- Instream cover (type and amount)
- Channel quality (sinuosity, development, channelization, and stability)
- Riparian/erosion (width, floodplain quality, land use, and bank erosion)
- Pool riffle (max. depth, current available, pool morphology, riffle/run depth, riffle substrate stability, riffle substrate embeddedness)
- Linear slope or gradient

The data analysis incorporates Ohio ecoregions and sampling methods (boat methods, wading methods, and headwater methods) into the statistical analysis.   The QHEI evaluates emergent habitat properties at the macro-scale instead of individual factors that determine these characters (current velocity, depth, substrate size). Scores are based on a weighted scale assigning higher possible values to those parameters which are considered more critical to ecological integrity (high biological diversity and biological integrity). Sites receiving higher scores within each metric category represent sites with more desirable habitat conditions, while lower scores represent less desirable conditions (Ohio EPA, 1989).

Texas Natural Resource Conservation Commission Water Quality Assessment

The Texas Natural Resource Conservation Commission (TNRCC) is responsible for regulating state water quality. The TNRCC developed multimetric indices for the evaluation of surface water and aquatic life use. Individual metrics include indices for fish, macroinvertebrate, and habitat evaluations. These indices are based on current literature, professional judgment, and field experience. The U.S. Environmental Protection Agency's Rapid Bioassessment Protocols (Plafkin et al., 1989, the Index of Biotic Integrity (IBI) (Karr et al., 1986), and the Texas Mean Point Score (MPS) (TNRCC, 1988) were instrumental documents in the development of the fish and macroinvertebrate indices used by TNRCC. The Habitat Quality Index (HQI) was adapted from various sources (Hornig, et al. in Davis and Simon, 1995). TNRCC modified the reference metrics in an effort to develop multimetric indices that are more appropriate to Texas ecoregions. This process began in 1986, with the Texas Aquatic Ecoregion Project, through a joint effort between the Texas Water Commission (TWC) and the Texas Parks and Wildlife Department (TPWD). The project identified and characterized minimally impacted streams of various sizes throughout the state. These impacted streams were to serve as a reference or benchmark for assessing the ecological integrity of streams of similar size within each zone. Additionally, these reference streams would provide characterization of reasonably attainable ecological conditions for similar streams.

The multimetric indices currently being used for assessing aquatic life uses and for revising the Texas Surface Water Quality Standards (TSWQS) consist of physical, chemical, and biological criteria. The habitat quality index used by TNRCC consists of the following parameters; instream cover, riffle/runs, pool depth, bank stability, riparian width, flow fluctuations, channel sinuosity, bottom substrate, and aesthetics. The assessment is conducted along a one-kilometer (0.62 miles) reach at each selected site. A general characterization of the reach includes a stream flow measurement, a description of the number and type of bends, the type of land use adjacent to the stream, the approximate width of the riparian vegetation; and the aesthetic value. Stream widths are taken along five to ten equally spaced transects using a tape or a range finder. At each transect location the stream is characterized as a run, glide, or pool. Estimates of instream cover (large woody debris, boulders, undercut banks, and vegetation), water depth, and substrate composition and stability are also made at points along each transect. Additionally, at each transect location, a visual observation (estimate) of the bank stability; the percent and type of vegetative cover; percent tree canopy; and percent bank slope is also taken.

The chemical metric for aquatic use assessment includes the following parameters: 1) dissolved oxygen, 2) ambient nutrient levels, 3) oxygen demanding substances, 4) conservative ionizable materials, 5) hardness, 6) turbidity, and 7) chlorophyll *a*. Grab samples or a twenty-four composite water sample is collected at each site and analyzed via standard laboratory testing procedures for each of the above chemical parameters except dissolved oxygen levels. Dissolved oxygen levels are taken over a twenty-four hour period during summer low-flow conditions establishing a minimum, maximum, and average concentration.

TNRCC's approach to biological data is slightly different from the previously discussed indices because reference conditions are standardized from a study of the least disturbed streams in each ecoregion rather than reference sites sampled concurrently with the area of interest. This method was developed for routine use in unclassified water bodies when evaluating TNRCC wastewater discharge permit applications. It is less time consuming for specific receiving water applications than more rigorous comparisons to reference sites. In the TNRCC methodology, three benthic macroinvertebrate samples are collected and composited. Taxonomic identification and enumeration are used to yield species richness, standing crop/area, EPT index, diversity, equitability, and community trophic structure. These values are compared to ranges set from ecoregion studies to categorize sites by limited, intermediate, high, or exceptional aquatic life use.

Fish are collected from representative habitats, identified, and 30 individuals are examined for physical condition and well being and the following metrics are calculated; species richness, standing crop/time, diversity, and index of biotic integrity (combining species richness and composition, trophic composition, abundance, and condition). Again, these values are compared to ecoregion based scores to categorize sites into an aquatic life use subcategory.

Kentucky Department of Environmental Protection Water Quality Assessment

The Kentucky Department of Environmental Protection uses an integrated approach to assessing the biological integrity of the state's surface waters. Their assessment and monitoring protocols include biological, physical, and chemical components. The stream habitat evaluation consists of both a qualitative and a quantitative assessment. The qualitative assessment data is recorded on a field data sheet that provides a quick reference checklist. This evaluation includes general spatial information about the stream being monitored, climatic information, and a visual assessment of the following parameters:

- <u>Stream Substrate and Instream Condition:</u> stream substrate, embeddedness, habitat and cover.
- <u>Stream Hydrology</u>: stream flow (dry, no flow or pooled, low, normal, high, or flooded), stream stage.
- <u>Channel Morphology:</u> stream condition (perennial, intermittent, or interrupted), stream-depth range, stream width range.
- <u>Streambank Stability:</u> vegetative cover, riparian vegetation (percent trees, shrubs, herbaceous plants).
- <u>Canopy</u>: exposure rating (exposure to solar radiation).
- <u>Human Impacts:</u> land use, instream hydraulic structures, channel alterations.

Color photographs or video recordings of the site are taken for further documentation when the equipment is available.

A more quantitative assessment of the stream habitat is also conducted. This assessment evaluates various habitat parameters, including stream widths, depth, flow, substrate type, substrate quality, bank stability, streamside cover, riparian zone width, canopy cover, channel alteration and pool/riffle ratio. Each of these parameters is scored based on a continuum of four categories of conditions from excellent to bad. The parameter scores are then totaled to arrive at an overall site score. Furthermore, a system of transects is used to provide an accurate description of the condition of the riparian zone. The vegetation analysis includes a species description (for trees, shrubs, and herbaceous plants) and a species ranking describing the percent cover of each species type (KDEP, 1993).

Montgomery County, Maryland - Rapid Stream Assessment Technique (RSAT)

This monitoring program was compiled by the Metropolitan Washington Council of Governments to be used by the Montgomery County Department of Environmental Protection to prioritize restoration attempts in the streams of the Maryland Piedmont area. Original development of the technique was completed in 1992 in order to identify channel erosion problem areas in medium size streams and to characterize stream integrity on a watershed scale. The structure of the technique uses six categories with scoring through narrative and verbal comparisons to a reference condition. Categories employed in the RSAT include Stream Stability, channel scouring/sediment deposition, physical aquatic habitat, water quality, riparian habitat conditions, and benthic macroinvertebrates. In all, over 30 physical, chemical, and biological parameters are measured at approximately 400-foot intervals along the stream evaluated with this technique. A riffle/transect approach is employed using typically 12-13 riffle transects per stream mile for smaller streams. Community structure and relative taxa abundance of benthic macroinvertebrates are compiled using EPA, RBP protocols. Verbal rating scores are taken in four categories, excellent, good, fair, and bad as well as numerical scores for each parameter.

Possible solutions to the more common stream impairment problems. A matrix system was developed to suggest solutions based on stream size and RSAT results. In addition, a Project

Prioritization method was developed and employed to systematically rank stream channel stabilization and NPS retrofit project needs for the stream segments evaluated using the RSAT. Five factors are figured into a prioritization matrix including overall accessibility, proximity of channel erosion to residences/buildings, environmental site sensitivity, level of existing upstream NPS controls, and relative stream problem level. Tributaries and streams with noted problems are categorized into priority levels based on number of points scored on the Project Prioritization form to target areas for examination of specific remedial measures. Implementation of the RSAT has been completed for over 140 stream miles of non-limestone Piedmont streams with drainage areas less than 150 square miles in the Washington area. Further anticipated development of the RSAT includes incorporation of digital photography, integration with local and regional GIS systems, development of a training course for widespread usage, creation of a regional stream channel morphology database, and expansion of the reference stream database. As part of the RSAT implementation process, a General Remedial Measures Guide was developed as a planning level screening tool to identify

Indices Comparisons and Guidance for EII Development

From comparison of the indices evaluated in Appendix F it can be seen that there are many similarities in the basic structure of these methods. The major differences are at the sub-index scale, between individual components. For example, each index mentioned has a water quality component based strictly on chemical analysis. However, very few of the indices used sediment sampling as a cumulative measure of impact and as a sink of non-point source pollutants. Also, the number of chemical parameters for water column samples varies significantly over the different indices evaluated. Some methods include toxic parameters whereas some are strictly concerned with field and conventional laboratory parameters. In contrast, all of the more recent indices employed a well developed physical and biological component whereas older indices referenced in the literature focus more on chemical water quality measurements.

None of the indices investigated have been organized around a beneficial use framework consistent with the development of theWater Quality Standards from the Clean Water Act.

One exception was noted in the TNRCC assessment method for unclassified waterbodies. However, this method focused on Aquatic life use categories without consideration of public water supply and recreational uses. In addition, Clean Water Act designated uses in Section 303c(2)(A) also included agriculture, industry, navigation, marinas, groundwater recharge, aquifer protection, and hydroelectric power. These uses are not identified directly by indicators noted in the indices investigated. Although many of these uses are not directly related to the streams under assessment by the EII, their contribution to the uses of downstream waterways is pertinent. Therefore, in the development of the EII, the protection of water quality to the most stringent use was adopted as a goal. Therefore, use categories for agriculture, industry, and hydroelectric would be addressed by the level of protection designated for aquatic life that typically has more stringent quality requirements. In this manner, parameters could be organized by use categories with a minimum of duplication.

Finally, implementation of most of the indices was for regional assessment rather than Watershed Protection Department planning. However, the RSAT included a prioritization and planning program, which closely resembles the planned use of the EII in the masterplanning process as a method to prioritize areas for water quality controls implemented by the City of Austin Watershed Protection.

Appendix B

	Phase 1- 1996
1	Barton Creek
2	Blunn Creek
3	Boggy (North) Creek
4	Bull Creek
5	Buttermilk Branch
6	Country Club Creek
7	East Bouldin Creek
8	Fort Branch
9	Harper's Branch
10	Johnson Creek
11	Little Walnut Creek
12	Shoal Creek
13	Tannehill Branch
14	Waller Creek
15	Walnut Creek
16	West Bouldin Creek
17	Williamson Creek

	Phase 2 - 1998
1	Bear Creek
2	Bee Creek
3	Carson Creek
4	Dry Creek (North)
5	Eanes
6	Huck's Slough
7	Lake Creek
8	Little Barton Creek
9	Little Bear Creek
10	Little Bee Creek
11	Rattan Creek
12	Slaughter Creek
13	South Boggy Creek
14	Taylor Slough (North)
15	Taylor Slough (South)
16	West Bull Creek

	Phase 3 -1999
1	Cottonmouth Creek
2	Decker Creek
3	Dry Creek (South)
4	Elm Creek
5	Gilleland Creek
6	Harris Branch
7	Lake Austin
8	Marble Creek
9	North Fork Dry Creek
10	Onion Creek
11	Rinard Creek
12	South Fork Dry Creek

Appendix B - Phase 1

SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
48	Barton Creek @ Hwy 71 Below Little Barton	Barton Creek at Hwy 71. Sample site is approx. 150 feet upstream of bridge.	Barton Creek
53	Barton Creek Above Barton Springs Pool	In Zilker Park, located off of Barton Springs Rd. The site is about 150 feet upstream from the Barton Springs Pool. There is a small wall or dam there.	Barton Creek
78	Barton Creek @ Hwy 71 Above Little Barton (BC0)	In Barton Creek upstream of confluence with Little Barton 200m upstream of SH71 bridge, past confluence at first wide cobble/gravel riffle with little or no canopy cover below old low water crossing	Barton Creek
82	Barton Creek Below Barton Creek Blvd (BC4)	West on Bee Caves Rd. to Canyon Rim Dr.(Camelot)Go left and follow to Leif Johnson Ranch gate.Enter 5302 into keypad. Enter and go rt. at all oppt.to large pasture.Go north to well housing.Site is riffle below confluence of Frazio Tributary.	Barton Creek
88	Barton Creek @ Lost Creek Bridge (BC10)	From Lost Creek Bridge crossing at Barton Creek walk downstream 400m past large swimming hole to large fast riffle. Cobble is large and pool below is all bedrock.	Barton Creek
879	Barton Creek Between Dams Above Pool	Barton Creek just before it's diverted around Barton Springs Pool; between the two dams above the pool	Barton Creek
180	Blunn Creek @ Riverside Drive	On Blunn Creek underneath the Riverside Dr Bridge NW of the intersection of Riverside Drive and Alta Vista Drive	Blunn Creek
362	Blunn Creek - Preserve at Little Bridge	Sampling Site is located within the Blunn Creek Nature Preserve. Park on Longbow Lane and take North Trail down to the creek.	Blunn Creek
363	Blunn Creek @ Willow Run	Blunn Creek 100 yards upstream of the Blunn Creek and Woodward St. Access just of Willow Run between to small apartment buildings.	Blunn Creek
364	Blunn Creek Above Stacy Pool	Blunn Creek at Stacy Park, Live Oak Street entrance. Sampling Site is just above Stacy Pool's discharge pipe.	Blunn Creek
493	Boggy (North) Creek @ Delwau Lane	North Boggy Creek at the Delwau Lane Bridge, east of 183 (EII).	Boggy (North) Creek
784	Boggy (North) Creek @ Airport Rd.	50 yards downstream of Airport Rd. Bridge between Parkwood and Crestwood	Boggy (North) Creek

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SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
837	Boggy (North) Creek @ Nile Road	Upstream of the Rosewood-Zaragosa Center off of Pleasant Valley Road at Walter and Nile; 100m upstream of concrete channelization (EII)	Boggy (North) Creek
853	Boggy (North) Creek @ Banton Road	Boggy Creek at intersection of Banton and Grayson Roads	Boggy (North) Creek
151	Tributary 6 @ Bull Creek (EG)	Bull Creek Tributary 6 which is developed and on the Hank's Track just above the Confluence with Tributary 5, west of the intersection of Wyndham Drive and Patrice Drive near collapsed	Bull Creek
347	Bull Creek Above West Bull Creek	Bull Creek above confluence with West Bull Creek near the intersection of 2222 and Loop 360	Bull Creek
350	Bull Creek @ Loop 360 First Crossing	Bull Creek at Loop 360 and north of the intersection of 360 Lakewood Dr. This is the first crossing of Loop 360 over Bull Creek.	Bull Creek
920	Bull Creek @ St. Eds Park above dam	On Bull Creek 200 meters above the large dam	Bull Creek
782	Buttermilk Creek @ Providence Ave	Buttermilk Creek in Buttermilk Branch Greenbelt. Site is 100' downstream of footbridge across creek in view of basketball court downstream	Buttermilk Branch
783	Buttermilk Creek @ Cameron Road	Downstream of intersection of Cameron Rd. and Anderson Ln., 100' downstream of Cameron Rd. Bridge.	Buttermilk Branch
851	Buttermilk Creek @ Little Walnut Creek	West on Hwy. 290 access from Hwy. 183, right on Creekside, right on Coronado, left on Old Town, right at last street. Walk down to wide bedrock bottom of Buttermilk just before the	Buttermilk Branch
852	Buttermilk Creek @ Chevy Chase Road	West of IH35 on Buttermilk Branch at Chevy Chase Drive	Buttermilk Branch
848	Country Club Creek Below Grove Drive	Near mouth of creek, located in the Colorado Greenbelt, downstream of Grove drive below water treatment plant	Country Club Creek
849	Country Club Creek @ Crossing Place Drive	Midreach of Country Club Creek at Crossing Place Drive	Country Club Creek
850	Country Club Creek @ East Oltorf St	Headwaters of Country Club Creek at E Oltorf Street	Country Club Creek
182	Eanes Creek @ Rollingwood	(Eanes) Dry Creek at the Austin Nature Preserve; the Barton Springs Road entrance underneath the Mopac Expressway (Loop 1), just north of Rollingwood, near mouth.	Eanes

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SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
1106	Eanes Creek @ Camp Craft Road	Eanes Creek downstream of Camp Craft Rd bridge, near the intersection of Camp Craft and Westbank Drive	Eanes
115	East Bouldin Creek @ Riverside Dr	On East Bouldin Creek behind Rockford Business Interiors 180 ft upstream of Riverside Drive bridge west of the intersection of Riverside Dr and Newning Avenue	East Bouldin Creek
119	East Bouldin Creek @ Elizabeth St	On Elizabeth St., which is between 1st and Congress streets. The creek crosses Elizabeth St. and the south end of the Texas State School for the Deaf.	East Bouldin Creek
120	East Bouldin Creek @ South Austin Center	At the South Austin Multipurpose Center, just south of the intersection of S. 1st and Oltorf streets.	East Bouldin Creek
121	East Bouldin Creek @ Alpine Rd	At Alpine Rd. just north of Alpine Rd. bridge. Alpine Rd. is between S. 1st and Congress streets, south of Lightsey Rd./Woodward St.	East Bouldin Creek
123	Fort Branch Creek @ Boggy Creek	Just north of Thurgood Ave., west of Hwy 183 (Ed Bluestein Blvd.), just above confluence with Boggy Creek	Fort Branch
125	Fort Branch Creek Above Manor Rd	Just east of the intersection of Peacedale Ln. and Westminster Rd. Power poles point to the site. This site is near the intersection of Manor Rd. and East 51st St.	Fort Branch
126	Fort Branch Creek @ Glencrest Drive	At Glencrest Drive between Berkman and Cameron Rd. just south of Hwy 290.	Fort Branch
898	Ft. Branch @ Single Shot	From MLK turn onto Bundyhill and park near intersection with Single Shot. Walk down to creek to the riffle with large concrete slab in water.	Fort Branch
484	Harper's Branch Creek @ Riverside Dr	Harper's Branch near the confluence with Townlake. Access site from the Motel at NE corner of Riverside Drive and IH-35. Sample site is approximately 40 ft from large storm water pipe which carries the flow underneath IH-35.	Harper's Branch
844	Harper's Branch @ Woodland	West side of IH35 and Woodland Ave., site is located downstream of Brooks Apt. parking lot in the middle of the complex.	Harper's Branch
855	Harper's Branch Creek @ Fairlawn	Harpers Branch Creek at Fairlawn and Mariposa	Harper's Branch

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SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
877	Harper's Branch @ Windoak	Headwater's site. Downstream of Matagorda and Windoak intersection.	Harper's Branch
847	Johnson @ South Tarrytown	Near intersection of Winstead and Tower Dr., site is 10 ft. downstream of the Tower Dr. bridge at south end of Tarrytown Park.	Johnson Creek
857	Johnson Creek @ 11th Street (EII)	Site is just east of the intersection of 11th and the southbound frontage road of MoPac. Sample just below culvert, between exit ramp and southbound MoPac	Johnson Creek
897	Johnson @ Woodmont	From southbound MOPac access road (Winstead), turn west on Woodmont and park at dead end. Walk downstream appx. 50 yds just above pipe crossing the creek. Site is just upstream of West Enfield Park.	Johnson Creek
634	Little Walnut Creek @ US183	Little Walnut upstream of U.S. 183	Little Walnut Creek
838	Little Walnut Creek @ Golden Meadow Rd	100 yards downstream of Golden Meadow Rd. Bridge north of Rutland (EII)	Little Walnut Creek
839	Little Walnut Creek @ Hermitage Drive	East of IH35 on Hermitage at corner of Hermitage and Furness; downstream of an eroded tributary and the bedrock area (EII)	Little Walnut Creek
840	Little Walnut Creek @ US290	100 yards upstream of US290 bridge; park at car window tinting establishment (EII)	Little Walnut Creek
116	Shoal Creek @ 24th St. (EII)	In Pease Park,just south of Lamar and 24th streets in the long riffle; once known as lower-midstream	Shoal Creek
117	Shoal Creek @ Shoal Edge Court (EII)	In the Shoal Creek Greenbelt near the long riffle area. The Greenbelt is just south of Allandale Rd., just east of Mopac (Loop 1); once known as upper-midstream	Shoal Creek
118	Shoal Creek @ Crosscreek Drive	North on Burnet Rd., past intersection West Anderson Ln. Left on Steck Ave. to Shoal Creek Blvd. Right on Shoal Creek Blvd. going north. Make a right at Crosscreek Dr. Site is on the	Shoal Creek
122	Shoal Creek Above 1st St.	At the train tracks and just below the Hike and Bike Trail north of W. 1st street. Approx 3rd street; once known as downstream/mouth	Shoal Creek
660	Tannehill Creek @ Givens Park	Tannehill at Givens Park in Oak Spring near Webberville Road, southwest of Plummers Cemetary.	Tannehill Branch

SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
841	Tannehill Creek @ Highland Mall	From the corner of Clayton and Middle Fiskville Rd at the edge of the parking lot of Highland Mall go upstream to first riffle (EII)	Tannehill Branch
842	Tannehill Creek @ Bartholomew Park	Downstream of large excavation pit near the parking lot of Bartholomew Park just off 51st St (EII)	Tannehill Branch
843	Tannehill Creek @ Lovell Drive	East on Lovell from Manor Rd at north end of Morris Williams golf course; site is 200 yards downstream od bridge and just downstream of the large pool (EII)	Tannehill Branch
854	Tannehill Creek @ Boggy Creek	Tannehill Branch Creek mouth site at Jain Lane	Tannehill Branch
38	Waller Creek Below Cesar Chavez	Sample site is in Waller Creek below Cesar Chavez (1st Street) approximately at Willow Street	Waller Creek
624	Waller Creek @ 23rd St. (USGS)	100 ft south of the intersection of 24th and San Jacinto; USGS site 08157500 (EII)	Waller Creek
780	Waller Creek @ 51st Street	North of 51st and UT Intramural fields, upstream of 36" outfall pipe on west bank.	Waller Creek
781	Waller Creek @ Shipe Park	In Shipe Park 100' downstream of Avenue G	Waller Creek
464	Walnut Creek Below IH35	Walnut at Below I-35 (EII)	Walnut Creek
465	Walnut Creek @ Loyola	Walnut Creek at the intersection of Loyola and Crystal Brook (EII)	Walnut Creek
500	Walnut Creek @ Springdale Rd	**(REFERENCE SITE)** Walnut Creek at Springdale Road, .5 miles north of US290.	Walnut Creek
503	Walnut Creek @ SP Railroad Bridge	Walnut Creek downstream of old Austin Northwestern (Southern Pacific) railroad bridge off Delwau Lane.	Walnut Creek
659	Walnut Creek @ Lamar Blvd	Upstream of Lamar Blvd. Brigde	Walnut Creek

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SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
486	West Bouldin Creek @ Riverside Drive	W. Bouldin Creek at the corner of Dawson and Riverside Drive. Sample site is 50 feet upstream of the bridge, above the storm water discharge pipe.	West Bouldin Creek
845	West Bouldin Creek @ Guerrero Park	50 feet upstream of Mary Street Bridge in Guerrero Park	West Bouldin Creek
846	West Bouldin Creek @ South Austin Park	100 meters upstream of Cumberland Rd Bridge in South Austin Park	West Bouldin Creek
878	West Bouldin Creek @ Jewell	Park where Jewell dead ends near W. Bouldin and walk downstream approximately 100 yards	West Bouldin Creek
223	Williamson Creek @ McKinney Falls (Will1)	Williamson Creek in McKinney Falls Park, above Lower Falls	Williamson Creek
300	Williamson Creek @ Mowinkle (MOW)	In Williamson Creek immediately upstream of the Mowinkle Road bridge north of the intersection of Mowinkle Drive and Towana Trail (Will 6)	Williamson Creek
344	Williamson Creek @ Joe Tanner (EII)	Drive west on highway 71/290 toward Oak Hill.At the intersection of Joe Tanner and highway 71/290 go south on Joe Tanner. Drive into the athletic field parking area next to the creek.The	Williamson Creek
490	Williamson Creek @ Hwy 71 (EII)	On Hwy 71 W vacant lot next to Diamond Shamrock gas station (7622 W Hwy 71)	Williamson Creek
491	Williamson Creek @ IH35 (EII)	Williamson Creek underneath IH35.	Williamson Creek
492	Williamson Creek @ Pleasant Valley (W2)	Williamson Creek at Pleasent Valley/Nuckols Crossing just upstream of bridge. This is an EII site, and is also known as W2	Williamson Creek

SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
600	Bear Creek below FM 1826 (USGS) (South Fork)	USGS site 08158810, near the Friendship church; this is south fork of Bear mainstem, west of Nutty Brown Rd and before the Barsana Dham temple	Bear Creek
1087	Bear Creek @ Twin Creeks Road	10m downstream of Twin Creeks Rd bridge over Bear Creek, near the intersection of Twin Creeks Rd and Arroyo Doble	Bear Creek
1088	Bear Creek @ Bears Den Court	100m upstream of Bears Den Court drainage easement access to Bear Creek, near the intersection of Bears Den Ct and Barker Hollow	Bear Creek
1089	Bear Creek Below FM 1826 (North Fork)	100m upstream of FM1826 on north fork of Bear Creek between N Madrone Trail and Bear Creek Dr	Bear Creek
1090	Bear Creek @ Spanish Oaks Circle	Bear Creek north of Spanish Oaks Circle, near the intersection of Spanish Oaks Cr and Cross Creek Drive	Bear Creek
319	Bee Creek @ Lake Austin	Mouth of Bee Creek at Lake Austin; access from Westlake Drive bridge over Bee Creek near the intersection of Westlake Drive and Hidden Cove	Bee Creek
884	Carson @ Pringle	Carson Creek at the intersection of Brandt Dr. and Pringle through the woods appx. 25 ft. down to the creek.	Carson Creek
1094	Carson Creek @ Shady Springs	Carson Creek downstream of dirt road in Shady Springs, located off Sherman Rd near the intersection of Sherman Rd and Dalton Lane	Carson Creek
1095	Carson Creek @ US 183	Carson Creek downstream of US183 frontage road between Dalton Lane and Jet Rd	Carson Creek
1096	Carson Creek @ Hoecke Lane	Carson Creek at Hoecke Lane bridge near the intersection of Hoecke Lane and Riverside Dr	Carson Creek

SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
1108	Dry Creek (North) @ Mt Bonnel Rd	Dry Creek (North) downstream of Mt Bonnel Drive bridge, near the intersection of Mt Bonnel Dr and FM2222	Dry Creek (North)
1109	Dry Creek (North) @ FM 2222	Dry Creek (North) upstream of the FM 2222 bridge, near the intersection of Oakwood Cove and FM2222 east of Mesa Dr	Dry Creek (North)
1110	Dry Creek (North) @ Highland Pass	Dry Creek (North) upstream of the Highland Pass bridge, near the intersection of Highland Pass and Hillbrook Dr	Dry Creek (North)
1093	Hucks Slough @ Mt Bonnel/Davis WTP	Hucks Slough downstream of Mount Bonnel Rd, above the confluence of Hucks Slough and Lake Austin near the intersection of Mt Bonnel and Old Bull Creek Rd	Huck's Slough
1098	Lake Creek @ Sugar Berry Cove	Downstream of Sugar Berry Cove access to Lake Creek, near the intersection of Willow Way and Sugar Berry Cove	Lake Creek
1099	Lake Creek @ Deep Wood Drive	Lake Creek upstream of Deep Wood Dr bridge, near the intersection of McNeil and Deep Wood Dr in the Round Rock West subdivision	Lake Creek
1100	Lake Creek Below Meadowheath Drive	Lake Creek downstream of Optimist Sports Complex located at the eastern end of Meadowheath Drive, near the intersection of Meadowheath and Briar Hollow Drive	Lake Creek
1119	Davis Spring Branch Creek @ Robinson Ranch	Davis Spring Branch Creek 50m above confluence with Lake Creek, .25 miles east of Parmer Lane on 620	Lake Creek
1120	Lake Creek @ Robinson Ranch	Lake Creek 100m upstream of Davis Spring Branch Creek confluence in Robinson Ranch, south of the intersection of 620 and Cornerwood Drive	Lake Creek
1113	Little Barton Creek @ Fandango Way	Little Barton Creek approximately 40m upstream of the Fandango Way bridge, south of the intersection of Fandango Way and Hwy 71	Little Barton Creek
1114	Little Barton Creek @ Great Divide Dr	Little Barton Creek approximately 50m downstream of Great Divide Drive, 0.5 miles south of the intersection of Great Divide Dr and RM 620	Little Barton Creek
1115	Little Barton Creek @ Hamilton Pool Rd	Little Barton Creek 50m downstream of Hamilton Pool Rd, south of the intersection of Hamilton Pool Rd and Cueva Drive	Little Barton Creek
1101	Little Bear Creek @ Bear Creek	Little Bear Creek just above confluence with Bear Creek upstream of the Lowden Road access to Bear Creek near the intersection of Lowden and FM1626 in Manchaca	Little Bear Creek

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SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
1102	Little Bear Creek @ Carpenter Rd	Little Bear Creek at Carpenter Rd bridge, near the intersection fo Carpenter Rd and Chapparal Rd	Little Bear Creek
1103	Little Bear Creek @ FM 967	Little Bear Creek at FM 967 bridge, 3 miles east of FM967 and FM1626 intersection on FM967	Little Bear Creek
272	Little Bee Creek @ Laurel Valley Rd (LVT)	West on Bee Caves (RR2244) to Westlake Dr. North on Westlake Dr. Drive about 1 mile to Laurel Valley Rd. West on Laurel Valley Rd. Creek is about 40 yds. from	Little Bee Creek
1105	Little Bee Creek @ Red Bud Trail	Little Bee Creek downstream of Red Bud Trail Bridge, between Westlake Drive and Forest View Drive on Red Bud Trail	Little Bee Creek
1009	Rattan Creek Above Parmer Lane	In riffle on Rattan Creek 200 meters upstream of Parmer Lane, between Dallas Dr and Tomayo Dr	Rattan Creek
1097	Rattan Creek @ Shadowbrook Circle	Rattan Creek above confluence with Lake Creek, at community access road bridge from Shadowbrooke Circle, near the intersection of Shadowbrooke and Creekview Rd	Rattan Creek
1082	Slaughter Creek @ Pine Valley Circle	Slaughter Creek in the Onion Creek Country Club development, near the intersection of Pinehurst Dr and Pine Valley Circle	Slaughter Creek
1083	Slaughter Creek @ River Oaks Drive	Slaughter Creek nouth of River Oaks Drive, near the intersection of River Oaks Dr and Red Bud Trail	Slaughter Creek
1084	Slaughter Creek Branch @ Hwy 45 West	20 m downtream of Hwy 45 West bridge over Slaughter Creek Branch, near the Circle C Golf Course	Slaughter Creek
1085	Slaughter Creek @ Escarpment Blvd	200m downstream of Escarpment Blvd bridge over Slaughter Creek, near the intersection of Slaughter Ln and Escarpment	Slaughter Creek
1086	Slaughter Creek @ Young Lane	30m upstream of Young Lane bridge over Slaughter Creek, near the intersection of Young Lane and Lewis Mt Drive, west of FM 1826	Slaughter Creek
227	South Boggy @ Bluff Springs Road (BO1)	From E. William Cannon east of I-35, take Bluff Springs Rd. south to South Boggy Creek.	South Boggy Creek
1080	South Boggy @ Loganberry Drive	200m downstream of Loganberry Dr, near intersection of Loganberry and Dittmar Rd; site is south of Dittmar at downstream end of park-type access	South Boggy Creek

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SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
1081	South Boggy @ W. Dittmar Rd	Site in Dittmar Park and Rec Center, 150m downstream of Dittmar Rd bridge over South Boggy Creek	South Boggy Creek
177	Taylor Slough North @ Pecos St (TSN)	Taylor North Slough at Pecos Street. Sampling site is just south of the intersection of Pecos and 35 th Street underneath the Pecos Street Bridge over Taylor Slough North;	Taylor Slough (North)
1091	Taylor Slough North @ Old Bull Creek Rd	Taylor Slough North at the Old Bull Creek Rd bridge, near the Davis WTP and the intersection of 35th and Timberwood Circle	Taylor Slough (North)
890	Taylor Slough South Below Reed Park	Taylor Slough South in Reed Park at intersection of River Rd and Pecos St; 1/4 mile downstream of swimming pool	Taylor Slough (South)
148	West Bull Creek @ Bell Mt. Road (ED)	West Bull Creek east of RR 2222 and Bell MT. Drive intersection	West Bull Creek
343	West Bull Creek Above Bull Creek (EK)	The mouth of West Bull Creek approx. 15 feet upstream of the confluence with Bull Creek.	West Bull Creek
1030	Cow Fork Bull Creek @ Long Canyon Drive	In riffle on Cow Fork Bull Creek upstream of Long Canyon Drive, near the intersection of Gibbs Hollow Cove and Long Canyon Drive	West Bull Creek
1107	West Bull Creek @ Jester Blvd	West Bull Creek downstream of Jester Blvd dead-end to West Bull, near the intersection of Jester and FM2222	West Bull Creek

Appendix B - Phase 3

SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
1205	Cottonmouth Creek @ Colton-Bluff Springs Rd	In Cottonmouth Creek 30m downstream of the Colton-Bluff Springs Road bridge 0.5 miles southeast of the intersection of McKinney Falls Pkwy and Colton-Bluff Springs Road in Travis	Cottonmouth Creek
1206	Cottonmouth Creek @ Dee Gabriel Collins Rd	In Cottonmouth Creek upstream of Dee Gabriel Collins Road Bridge over Cottonmouth Creek immediately south of the intersection of Dee Gabriel Collins and Cottonmouth School Road in Travis Couth near Pilot Knob	Cottonmouth Creek
1207	Cottonmouth Creek @ Colton Road	In Cottonmouth Creek downstream of Colton Road bridge over Cottonmouth Creek north 0.75 miles north of the intersection of US183 and FM812 in Travis County upstream of confluence	Cottonmouth Creek
1196	Decker Creek @ Lindell Lane	In Decker Creek immediately downstream of Lindell Lane crossing 0.375 miles east of the intersection of Lindell Lane and Decker Lane in Lake Walter E Long Metro Park	Decker Creek
1197	Decker Creek @ FM973	In Decker Creek immediately downstream of FM973 bridge over Decker Creek and downstream of Lake Walter E Long 0.5 miles northeast of the intersection of Decker Lake	Decker Creek
1198	Decker Creek @ Decker Creek Cove	In Decker Creek east of the end of Decker Creek Cove upstream of the confluence with Gilleland Creek near the intersection of FM 969 and Decker Creek Drive	Decker Creek
1208	Dry Creek (South) @ FM 812	In main stem of Dry Creek (South) upstream of the FM 812 bridge over Dry Creek0.5 miles northwest of the intersection of Piland Triangle and FM 812 in Travis County	Dry Creek (South)
1209	Dry Creek (South) @ Elroy Road	In Dry Creek (South) downstream of the Elroy Road bridge over Dry Creek in Elroy Acres Subdivision 0.375 miles southeast of the Elroy Road and Ross Road intersection in Travis County	Dry Creek (South)
1210	Dry Creek (South) @ Wolf Lane	In main stem of Dry Creek (South) upstream of Wolf Lane bridge over Dry Creek 0.82 miles south of the intersection of Wolf Lane and SH71 in Travis County	Dry Creek (South)
1211	Dry Creek (South) @ Pearce Road	In mainstem of Dry Creek (South) upstream of Pearce Lane bridge over Dry Creek 1.3 miles northwest of the intersection of Pearce Lane and Timber Hills Drive in Travis County	Dry Creek (South)
1212	Dry Creek (South) @ River Road	In Dry Creek (South) upstream of River Road bridge over Dry Creek near Travis/Bastrop County Line 1.1 miles northeast of Tucker Hill Lane and SH 71 intersection	Dry Creek (South)
1213	Dry Creek (South) @ Colorado Drive	In mainstem of Dry Creek (South) at low water crossing downstream of Colorado Drive bridge over Dry Creek in River Crossing Subdivision near the intersection of CR335 and Colorado	Dry Creek (South)
887	Elm Creek @ Milo Rd	Drive on FM 969 to Dunlap, turn east on Milo Rd., site is at the low water crossing	Elm Creek

Appendix B - Phase 3

SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
1202	West Elm Creek @ Blue Bluff Road	In westernmost branch of Elm Creek upstream of Blue Bluff Road bridge north of the intersection of Blue Bluff Road and FM 973 in Travis County	Elm Creek
1203	East Elm Creek @ Catherine Road	In easternmost branch of Elm Creek upstream of confluence with western branch downstream of Catherine Road bridge north of the intersection of Blue Bluff Road and Catherine Road in	Elm Creek
1204	Elm Creek @ FM 973	In Elm Creek downstream of FM 973 bridge south of the intersection of FM 973 and FM 969 in Travis County	Elm Creek
886	Gilleland Creek @ FM 969	In Gilleland Creek at the FM 969 Bridge in Travis County 0.5 miles west of the intersection of the FM969 and Burleson-Manor Road	Gilleland Creek
1191	Gilleland Creek @ West Parsons St	In Gilleland Creek 1000ft south of the Austin&NW Railroad Tracks downstream of the Travis County East Rural Comm Center. Site is west of West Parsons St and South Lexington St intersection in Manor below confluence of Gilleland and large tributary	Gilleland Creek
1192	Gilleland Creek @ FM 973	In Gilleland Creek downstream of the FM 973 bridge over Gilleland Creek and 400ft north of the intersection of FM973 and Bloor Road in Travis County east of Lake Walter E Long Metro	Gilleland Creek
1193	Gilleland Creek @ South Railroad Avenue	In Gilleland Creek at the S Railroad Ave/E Pflugerville Loop in Gilleland Creek Park north of the intersection of S Railroad Ave and West Pecan Street in Pflugerville	Gilleland Creek
1194	West Gilleland Creek @ Cameron Road	In westernmost tributary of Gilleland Creek (called West Gilleland Creek) at Cameron Road bridge 0.25 miles northeast of the intersection of Cameron Road and Gregg Lane	Gilleland Creek
1195	Gilleland Creek @ Hill Cemetary	In Gilleland Creek west of Hill Cemetary and 0.375 miles west of the intersection of Hill Lane and Gregg Manor Road in Travis County	Gilleland Creek
888	Harris Branch @ Cameron	Harrris Branch Creek immediately downstream of the Cameron Rd. bridge; sample at the first creek south of Boyce Lane and Cameron Rd. intersection.	Harris Branch
1199	Harris Branch Creek @ Crystal Bend Drive	In Harris Branch Creek downstream of the Crystal Bend Drive bridge over Harris Branch north of the intersection of Gregg Lane and Dessau Road	Harris Branch
1200	Harris Branch Creek @ Fay Street	In Harris Branch Creek northeast of the end of Fay Street and southwest of the intersection of Cameron Road and Gregg Lane in Travis County	Harris Branch
1201	Harris Branch Creek @ Boyce Lane	In Harris Branch Creek downstream of Boyce Lane bridge north of the intersection of Boyce Lane and Farmhaven Road in Travis County	Harris Branch
1048	Common Ford Tributary in Common Ford Metro Park	In riffle on Common Ford Trib in Common Ford Park 50m downstream of park road crossing	Lake Austin

Appendix B - Phase 3

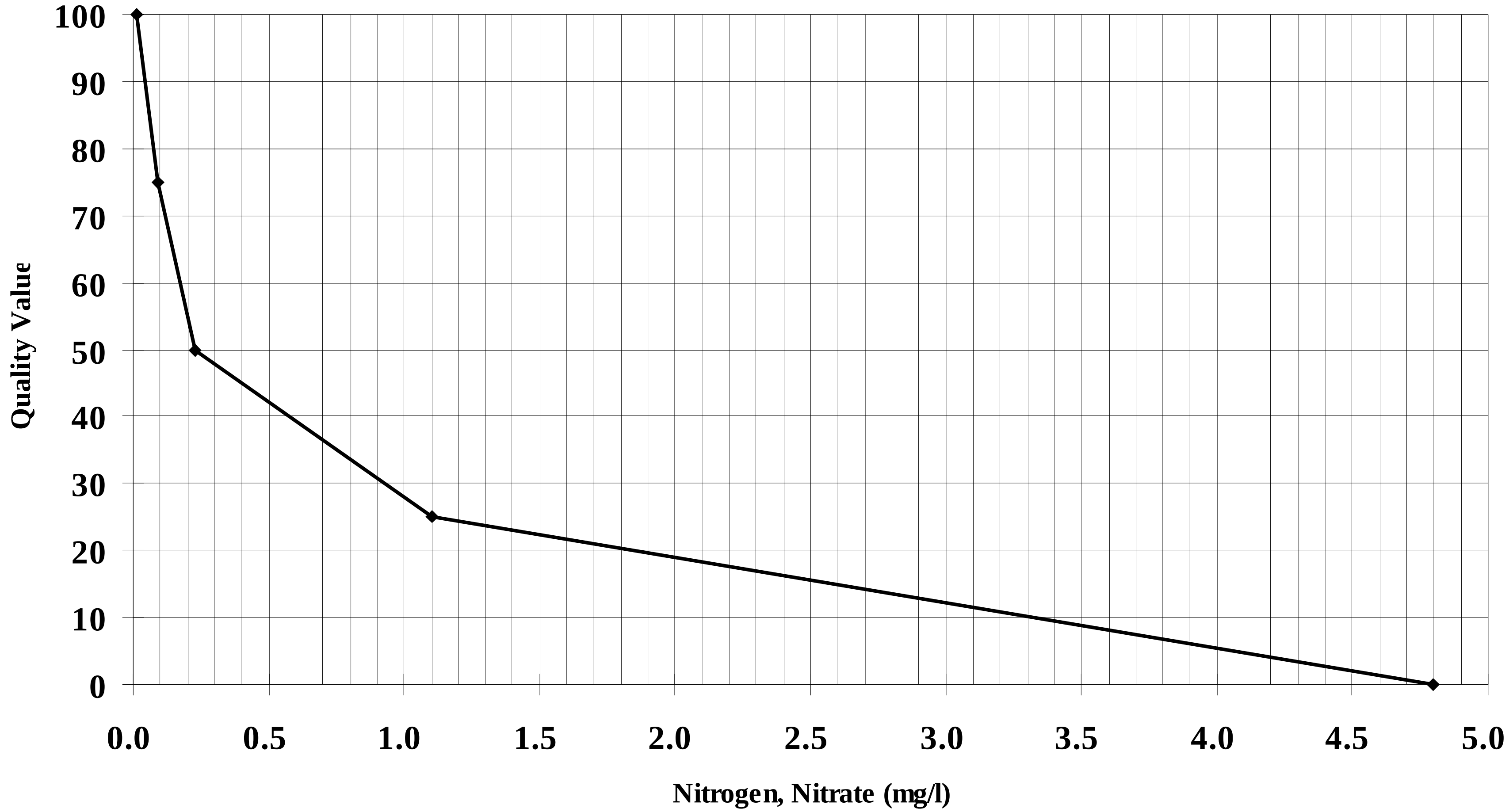
SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
1221	Turkey Creek @ City Park Road	In Turkey Creek mainstem at the City Park Road bridge over the creek in Emma Long Metro Park 0.25 miles west of the intersection of City Park Road and Pearce Road	Lake Austin
1222	Cuernavaca Creek @ River Hills Road	In Cuernavaca Creek upstream of the River Hills Road bridge and above the confluence with Lake Austin 0.375 miles south of the intersection of Cuernavaca Drive and River Hills Road in	Lake Austin
1223	Panther Hollow Creek @ Big View Road	In Panther Hollow Creek upstream of the wastewater retention pond and above the confluence with Lake Austin at the end of Big View Drive 0.75 miles south of the intersection of Love Bird	Lake Austin
1224	Bear Creek (North) @ Fritz Hughes Park Road	In Bear Creek (North) at the Fritz Hughes Park Road bridge above the confluence of Bear with Lake Austin 0.25 miles northeast of Fritz Hughes Park near the intersection of Fritz Hughes Pk	Lake Austin
1225	Unnamed Tributary @ Running Deer Trail	In unnamed tributary to Lake Austin at Running Deer Trail road bridge above the confluence with Lake Austin and east of the intersection of Running Deer Trail and Geronimo Trail in	Lake Austin
1226	Harrison Hollow @ Pecan Drive	In Harrison Hollow north of Pecan Drive above the confluence with Lake Austin and 0.19 miles west of the intersection of Pecan Drive and Underhill Road in Travis County	Lake Austin
231	Marble Creek Above Onion Creek (M#1)	In Marble Creek 0.2 miles upstream of confluence with Onion Creek and NNE of intersection of William Cannon and Running Water Dr; from the end of E. William Cannon go through the	Marble Creek
232	Marble Creek @ Thaxton (M2)	Marble at Thaxton. Take Colton Bluff Springs Road to Thaxton. Head south to the creek.	Marble Creek
1217	North Fork Dry Creek @ FM812	In North Fork Dry Creek 50m downstream of FM812 bridge and upstream of confluence with South Fork Dry and 0.25 miles east of the intersection of FM812 and Lonesome Lane in Travis	North Fork Dry Creek
1218	North Fork Dry @ US183	In headwaters of North Fork Dry Creek downstream of US183 bridge over North Fork Dry approximately 0.125 miles south of the intersection of FM1625 and US183 near Colton in	North Fork Dry Creek
220	Onion Creek @ Old Lockhart Hwy (ON4)	Onion at Lockhart Highway. Travel south on Bluff Springs Road, past Boggy Creek, to Onion Creek.	Onion Creek
236	Onion Creek @ Twin Creek Bridge (OC1)	**(REFERENCE SITE)** Twin Creek Bridge at Onion Creek, 250m upstream of the intersection of Twin Creeks and Arroyo Doble.	Onion Creek
239	Onion Creek Above IH35 (OC2)	Above I-35 @ Onion Creek	Onion Creek
255	Onion Creek @ McKinney Falls Below Lower Falls	On Onion Creek in McKinney Falls State Park in or below main pool downstream of lower falls below the confluence with Williamson Creek (ON1) (OC8)	Onion Creek
883	Onion Creek @ FM 973	Onion Creek just downstream of the FM 973 Bridge.	Onion Creek

Appendix B - Phase 3

SAMPLE SITE NO.	SITE NAME	LOCATION	WATERSHED
1116	Onion Creek @ Hwy 12	Onion Creek 30m downstream of the Hwy 12 bridge, 1 mile south of the "T" intersection of Hwy 12 and 1826, 2 miles north of Driftwood	Onion Creek
1117	Onion Creek @ Hwy 150	Onion Creek 10m upstream of the Hwy 150 low water crossing, 3.6 miles south of the intersection of Hwy 150 and 1826	Onion Creek
1118	Onion Creek South Fork @ Hwy 12	Southern fork of Onion Creek 50m downstream of the Hwy 12 bridge, 2.5 miles south of the "T" intersection of Hwy 12 and 1826, 2 miles north of Driftwood	Onion Creek
233	Rinard Creek @ Bradshaw	In Rinard Creek 100ft downstream of Bradshaw Road and 0.7 miles upstream of confluence with Onion Creek at low water crossing	Rinard Creek
1219	Rinard Creek @ FM1327 and Bradshaw Road	In western branch of Rinard Creek 200 yards northeast of the intersection of Bradshaw Road and FM 1327 in Travis County	Rinard Creek
1220	Rinard Creek @ FM1327	In mainstem of Rinard Creek downstream of FM1327 bridge and 0.75 miles southeast of the intersection of FM1327 and N Turnersville Road near Creedmoore	Rinard Creek
1214	South Fork Dry Creek @ Rodriguez Rd	In South Fork Dry Creek upstream of Rodriguez Road Bridge 0.31 miles southeast of Rodriguez Road and FM 1625 intersection in Travis County near Coulver Estates Subdivision	South Fork Dry Creek
1215	South Fork Dry Creek @ US183	In South Fork Dry Creek downstream of US183 bridge over South Fork Dry 1.25 miles south of the intersection of US183 and FM1625 in Travis County	South Fork Dry Creek
1216	South Fork Dry Creek @ FM812	In South Fork Dry Creek downstream of the FM812 bridge and upstream of the confluence of South Fork Dry with North Fork Dry 0.75 miles southeast of the intersection of FM812 and Lonesome Lane in Travis County	South Fork Dry Creek

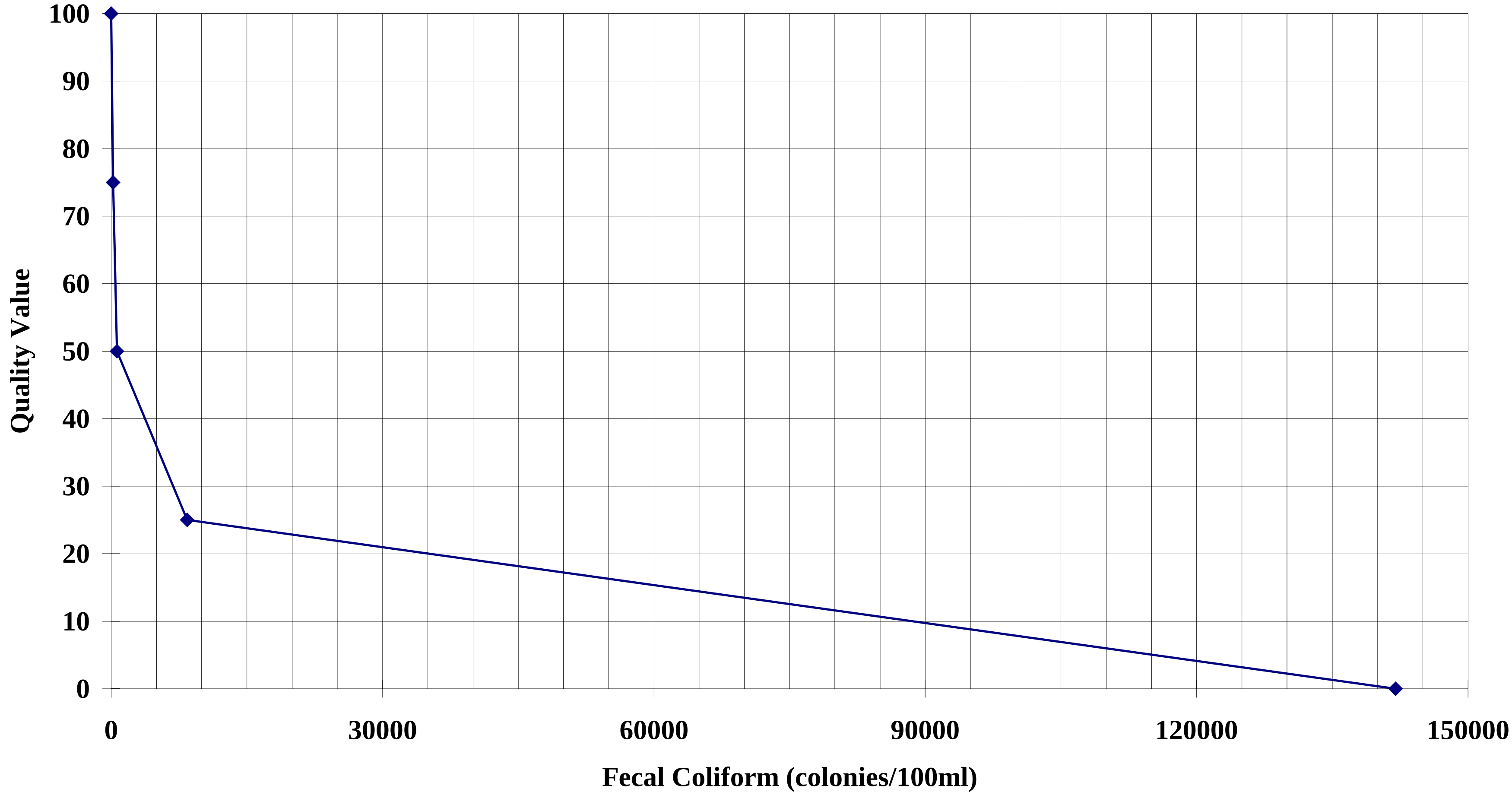
Appendix C

Nitrogen, Nitrate



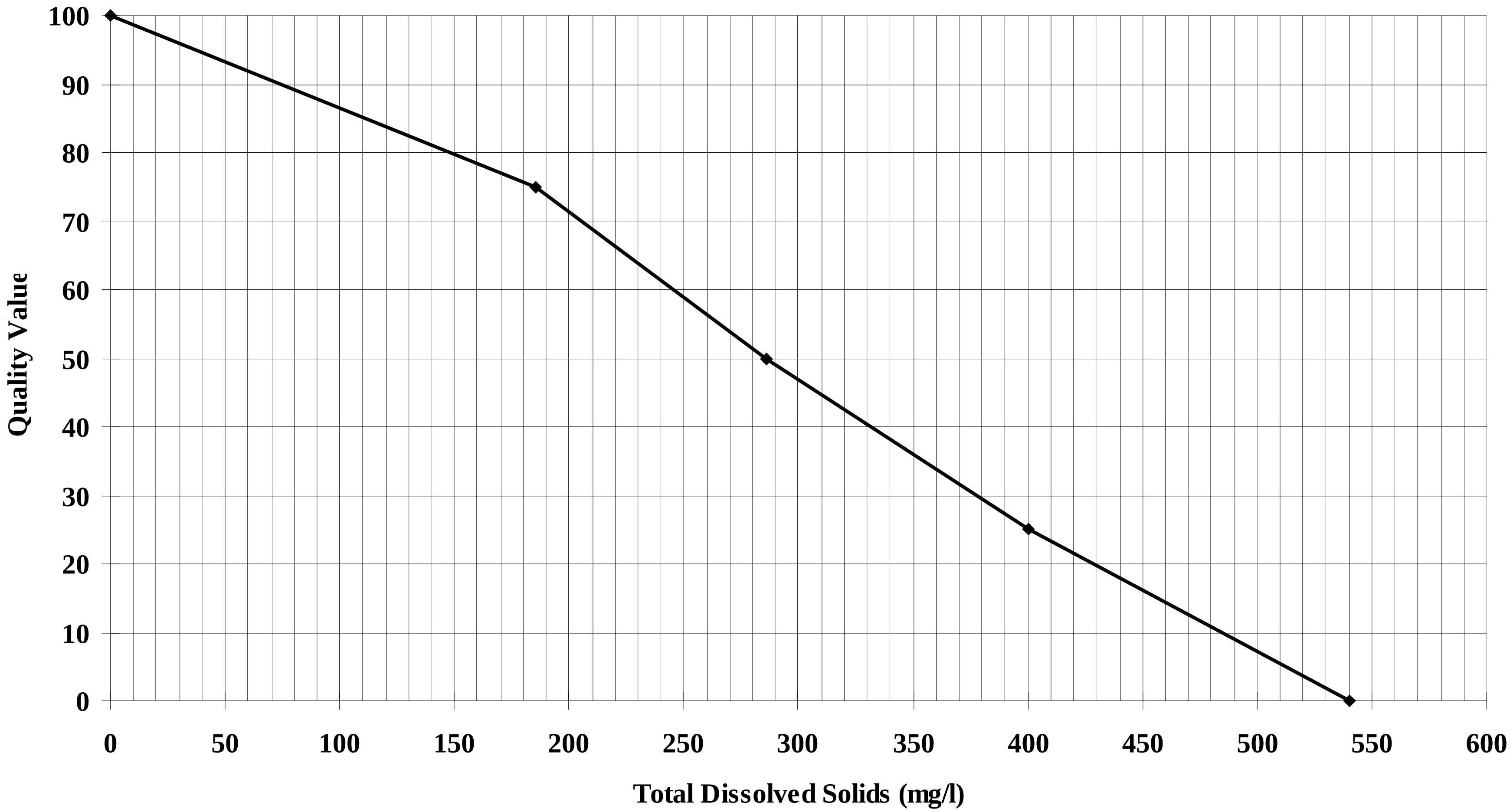
Appendix C

Fecal Coliform

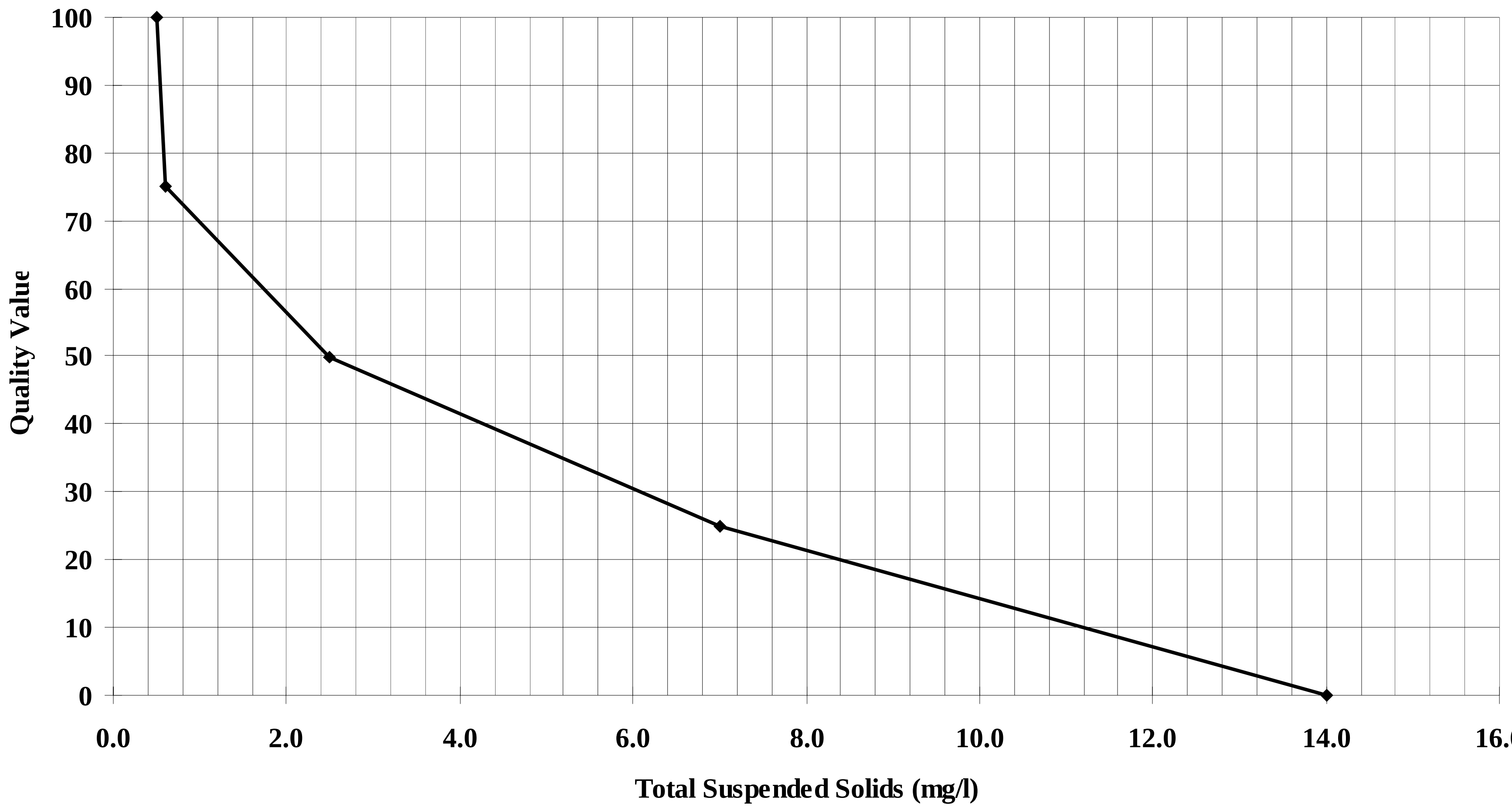


Appendix C

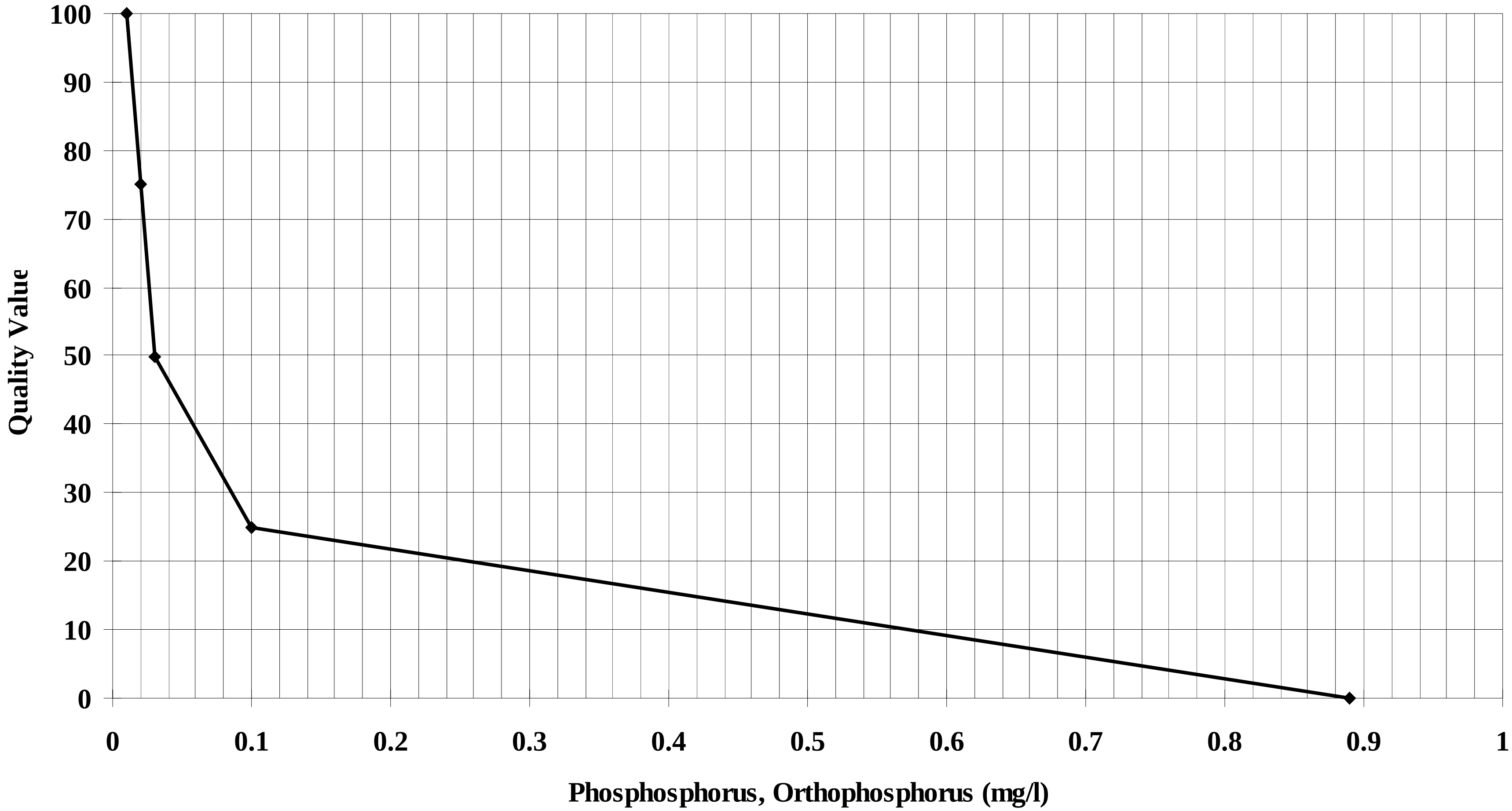
Total Dissolved Solids



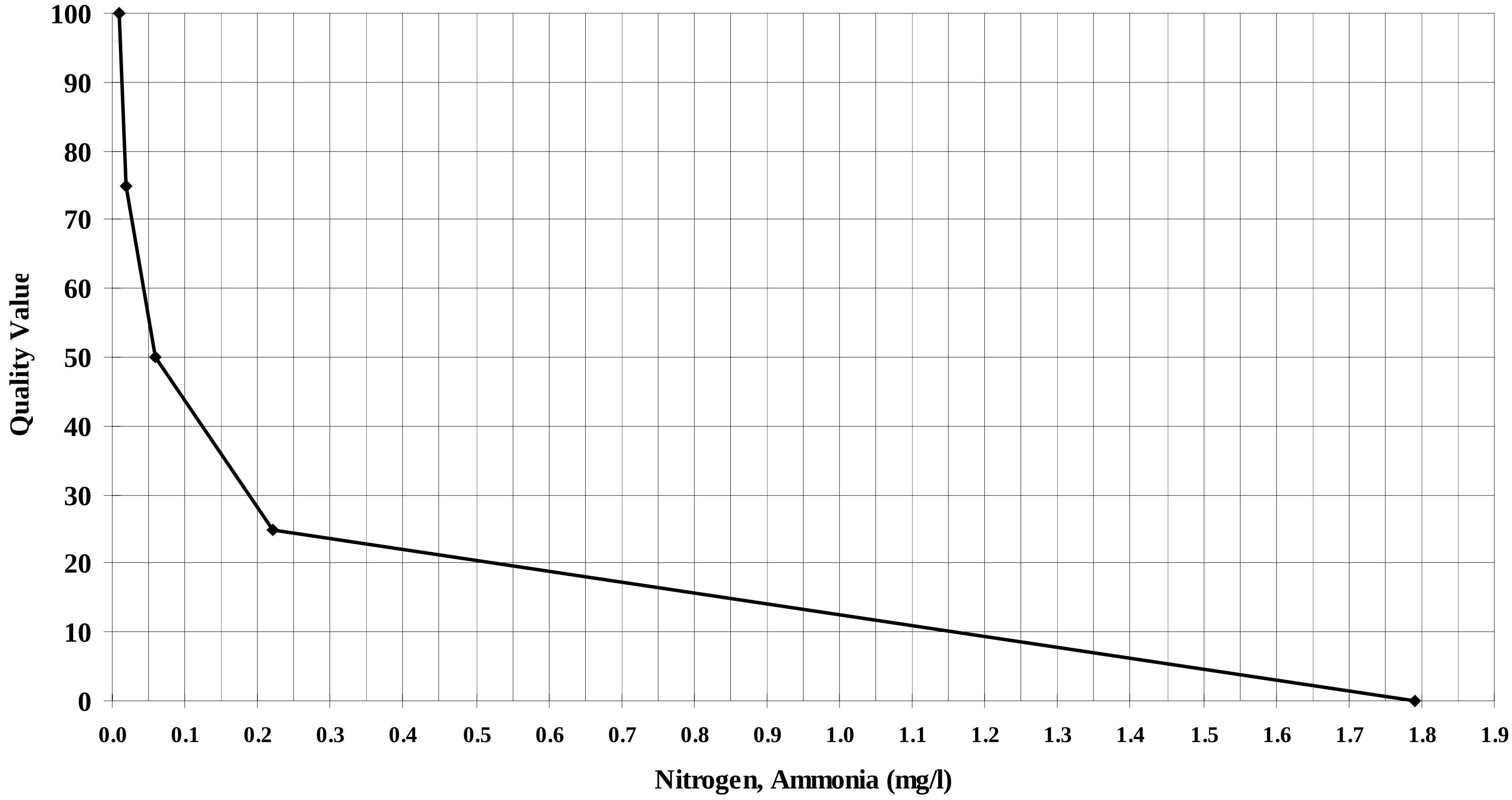
Total Suspended Solids



Phosphosphorus, Orthophosphorus



Nitrogen, Ammonia



Appendix D - 1994, 1995 EII Overall Scores and Rankings[†]

Site #	Sample Site Name	Date	Aquatic Life**		Contact Rec.		Non-Contact Rec.		Physical Integrity		Sediment		Water Qaulity		Overall *	
			Score	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*	*Score*	*Rank*
78	**Barton Creek @ Hwy 71 Above Little Barton**	**1994**	**86**	*1*	**98**	*6*	**96**	*1*	**94**	*1*			**76**	*5*	**82**	*2*
88	**Barton Creek @ Lost Creek Bridge**	**1994**	**72**	*4*	**91**	*13*	**90**	*6*	**81**	*4*			**62**	*16*	**73**	*8*
53	**Barton Creek Above Barton Springs Pool**	**1994**	**64**	*6*	**99**	*3*	**80**	*14*	**87**	*2*	**43**	*9*	**56**	*19*	**72**	*9*
121	**East Bouldin Creek @ Alpine Rd**	**1994**	**20**	*30*	**58**	*29*	**82**	*12*	**43**	*33*			**38**	*32*	**48**	*29*
119	**East Bouldin Creek @ Elizabeth St**	**1994**	**32**	*27*	**69**	*23*	**69**	*23*	**46**	*28*			**54**	*22*	**53**	*25*
115	**East Bouldin Creek @ Riverside Dr**	**1994**	**18**	*31*	**67**	*24*	**64**	*30*	**51**	*23*	**45**	*8*	**41**	*30*	**48**	*29*
120	**East Bouldin Creek @ South Austin Center**	**1994**	**5**	*36*	**52**	*31*	**70**	*22*	**53**	*19*			**60**	*17*	**48**	*31*
40	**Town Lake @ East Bouldin Creek**	**1994**									**46**	*7*				
123	**Fort Branch Creek @ Boggy Creek**	**1994**	**17**	*32*	**98**	*6*	**79**	*16*	**49**	*25*	**81**	*4*	**73**	*6*	**66**	*15*
126	**Fort Branch Creek @ Glencrest Drive**	**1994**	**14**	*35*	**59**	*28*	**85**	*7*	**53**	*19*			**51**	*24*	**57**	*23*
124	**Fort Branch Creek @ MLK**	**1994**	**50**	*14*	**98**	*6*	**65**	*28*	**39**	*36*			**56**	*19*	**58**	*22*
125	**Fort Branch Creek Above Manor Rd**	**1994**	**41**	*23*	**94**	*10*	**83**	*11*	**42**	*35*			**67**	*9*	**68**	*13*
116	**Shoal Creek @ 24th St. (EII)**	**1994**	**17**	*32*	**98**	*6*	**67**	*27*	**47**	*27*			**47**	*25*	**55**	*24*
118	**Shoal Creek @ Crosscreek Drive**	**1994**	**15**	*34*	**86**	*18*	**79**	*16*	**53**	*19*			**65**	*12*	**59**	*21*
117	**Shoal Creek @ Shoal Edge Court**	**1994**	**36**	*25*	**84**	*20*	**81**	*13*	**56**	*16*			**65**	*12*	**63**	*20*
122	**Shoal Creek Above 1st St.**	**1994**	**21**	*29*	**20**	*35*	**53**	*34*	**48**	*26*			**31**	*35*	**38**	*36*
15	**Town Lake @ Shoal Creek**	**1994**									**53**	*6*				
78	**Barton Creek @ Hwy 71 Above Little Barton**	**1995**	**77**	*2*	**99**	*3*	**92**	*4*	**82**	*3*	**97**	*1*	**89**	*1*	**82**	*1*
88	**Barton Creek @ Lost Creek Bridge (BC10)**	**1995**	**65**	*5*	**99**	*3*	**96**	*1*	**81**	*4*			**83**	*2*	**80**	*3*
53	**Barton Creek Above Barton Springs Pool**	**1995**	**76**	*3*	**81**	*22*	**92**	*4*	**74**	*7*	**55**	*5*	**72**	*7*	**75**	*6*
121	**East Bouldin Creek @ Alpine Rd**	**1995**	**32**	*27*	**38**	*33*	**68**	*24*	**61**	*11*			**47**	*25*	**46**	*32*
119	**East Bouldin Creek @ Elizabeth St**	**1995**	**54**	*12*	**60**	*26*	**73**	*19*	**54**	*18*			**43**	*28*	**52**	*26*
115	**East Bouldin Creek @ Riverside Dr**	**1995**	**45**	*20*	**36**	*34*	**45**	*35*	**56**	*16*			**34**	*33*	**41**	*35*
120	**East Bouldin Creek @ South Austin Center**	**1995**	**46**	*18*	**43**	*32*	**72**	*20*	**59**	*14*			**43**	*28*	**49**	*27*
40	**Town Lake @ East Bouldin Creek**	**1995**									**29**	*11*				
123	**Fort Branch Creek @ Boggy Creek**	**1995**	**46**	*18*	**84**	*20*	**68**	*24*	**46**	*28*	**95**	*2*	**64**	*14*	**67**	*14*
126	**Fort Branch Creek @ Glencrest Drive**	**1995**	**34**	*26*	**100**	*1*	**84**	*10*	**59**	*14*			**55**	*21*	**71**	*10*
124	**Fort Branch Creek @ MLK**	**1995**	**42**	*22*	**87**	*17*	**60**	*31*	**45**	*31*			**64**	*14*	**66**	*17*

** Overall score uses sediment score from the mouth of each site*

*** Aquatic Life Scores are calculate according to the 1996 methodology as well as adjusted to account for missing components.*

[U]Rank range is approximatelly 1 to 36. Higher (optimal) scores are indicated by lower rank value.

Appendix D - 1994, 1995 EII Overall Scores and Rankings[†]

Site #	Sample Site Name	Date	Aquatic Life**		Contact Rec.		Non-Contact Rec.		Physical Integrity		Sediment		Water Qaulity		Overall *	
125	Fort Branch Creek Above Manor Rd	1995	37	*24*	90	*14*	85	*7*	45	*31*			66	*10*	70	*12*
116	Shoal Creek @ 24th St. (EII)	1995	49	*15*	57	*30*	68	*24*	43	*33*			39	*31*	48	*28*
118	Shoal Creek @ Crosscreek Drive	1995	58	*10*	88	*15*	58	*32*	65	*9*			79	*4*	64	*19*
117	Shoal Creek @ Shoal Edge Court (EII)	1995	61	*8*	0	*36*	79	*16*	61	*11*			23	*36*	43	*34*
122	Shoal Creek Above 1st St.	1995	48	*17*	60	*26*	40	*36*	52	*22*			33	*34*	45	*33*
15	Town Lake @ Shoal Creek	1995									34	*10*				
490	Williamson Creek @ Hwy 71 (EII)	1995	54	*12*	88	*15*	65	*28*	66	*8*			58	*18*	70	*11*
491	Williamson Creek @ IH35 (EII)	1995	49	*15*	85	*19*	55	*33*	51	*23*			54	*22*	64	*18*
344	Williamson Creek @ Joe Tanner (EII)	1995	60	*9*	61	*25*	72	*20*	46	*28*			66	*10*	66	*16*
223	Williamson Creek @ McKinney Falls	1995	44	*21*	93	*11*	94	*3*	77	*6*	90	*3*	46	*27*	74	*7*
300	Williamson Creek @ Mowinkle (MOW)	1995	62	*7*	100	*1*	80	*14*	63	*10*			80	*3*	79	*4*
492	Williamson Creek @ Pleasant Valley (W2)	1995	56	*11*	93	*11*	85	*7*	61	*11*			69	*8*	76	*5*

** Overall score uses sediment score from the mouth of each site*

*** Aquatic Life Scores are calculate according to the 1996 methodology as well as adjusted to account for missing components.*

[U]Rank range is approximatelly 1 to 36. Higher (optimal) scores are indicated by lower rank value.

Appendix D - 1994, 1995 EII Non Contact Recreation Scores

Site #	Sample Site Name	Parameter / Date	CLARITY	FLOW	LITTER	ODOR	OIL/FOAM	SURFACE APPEARANCE
			Rating 1-20(Poor-Optimal)					
78	Barton Creek @ Hwy 71 Above Little Barton	12/02/94	20	17	20	19	17.5	19.5
88	Barton Creek @ Lost Creek Bridge (BC10)	12/02/94	17.5	18	17	19.5	19	15.5
53	Barton Creek Above Barton Springs Pool	12/02/94	19	15	14.5	19	17	15
121	East Bouldin Creek @ Alpine Rd	11/21/94	17	17	9.5	17	18	17.5
119	East Bouldin Creek @ Elizabeth St	11/21/94	15	13.5	7.5	13	14.5	15
115	East Bouldin Creek @ Riverside Dr	11/21/94	15	12	4.5	17	9	8
120	East Bouldin Creek @ South Austin Center	11/21/94	15	14	7.5	18	18	15.5
123	Fort Branch Creek @ Boggy Creek	11/21/94	19	12.5	6	19	14	18
126	Fort Branch Creek @ Glencrest Drive	11/21/94	19	16	13	19.5	19	19
124	Fort Branch Creek @ MLK	11/21/94	15	9	10	18	16	8.5
125	Fort Branch Creek Above Manor Rd	11/21/94	17.5	14.5	10	18	18	19
116	Shoal Creek @ 24th St. (EII)	11/22/94	17	11	15	15.5	15	10.5
118	Shoal Creek @ Crosscreek Drive	11/22/94	15.5	16.5	15.5	17	7	10
117	Shoal Creek @ Shoal Edge Court (EII)	11/22/94	19	18	14	18.5	19	17.5
122	Shoal Creek Above 1st St.	11/22/94	16	16	3.5	12	18	14.5
78	Barton Creek @ Hwy 71 Above Little Barton	06/30/95	15	20	19	20	20	20
78	Barton Creek @ Hwy 71 Above Little Barton	06/30/95	10	20	20	20	16	19
53	Barton Creek Above Barton Springs Pool	06/30/95	15	20	16	20	15	18
53	Barton Creek Above Barton Springs Pool	06/30/95	16	20	20	20	20	18
121	East Bouldin Creek @ Alpine Rd	06/26/95	5	18	16	18	18	18
121	East Bouldin Creek @ Alpine Rd	06/26/95	16	11	6	17	5	11
119	East Bouldin Creek @ Elizabeth St	06/26/95	18	13	5	17	18	15
119	East Bouldin Creek @ Elizabeth St	06/26/95	18	16	10	18	18	16
115	East Bouldin Creek @ Riverside Dr	06/26/95	6	9	3	15	4	3
115	East Bouldin Creek @ Riverside Dr	06/26/95	15	6	5	16	16	11
120	East Bouldin Creek @ South Austin Center	06/26/95	16	16	6	16	16	18
120	East Bouldin Creek @ South Austin Center	06/26/95	20	11	5	20	20	16
123	Fort Branch Creek @ Boggy Creek	06/27/95	19	15	10	16	15	16
123	Fort Branch Creek @ Boggy Creek	06/27/95	16	13	1	14	16	16
126	Fort Branch Creek @ Glencrest Drive	06/27/95	18	20	19	20	18	19
126	Fort Branch Creek @ Glencrest Drive	06/27/95	12	16	10	18	10	16
124	Fort Branch Creek @ MLK	06/27/95	14	9	12	15	8	18
124	Fort Branch Creek @ MLK	06/27/95	14	6	10	16	12	6

Appendix D - 1994, 1995 EII Non Contact Recreation Scores

Site #	Sample Site Name	Parameter / Date	CLARITY	FLOW	LITTER	ODOR	OIL/FOAM	SURFACE APPEARANCE
			Rating 1-20(Poor-Optimal)					
125	Fort Branch Creek Above Manor Rd	06/27/95	18	14	19	20	20	20
125	Fort Branch Creek Above Manor Rd	06/27/95	12	18	11	18	18	20
55	Lost Creek Residential Tributary (LCR)	06/30/95	20	20	18	17	20	20
55	Lost Creek Residential Tributary (LCR)	06/30/95	20	19	19	20	20	18
116	Shoal Creek @ 24th St. (EII)	06/28/95	11	7	18	18	11	17
116	Shoal Creek @ 24th St. (EII)	06/28/95	19	6	18	10	18	11
336	Shoal Creek @ 31st St. (EII)	06/28/95	11	1	13	11	11	3
336	Shoal Creek @ 31st St. (EII)	06/28/95	3	1	17	5	18	1
118	Shoal Creek @ Crosscreek Drive	06/28/95	16	15	18	14	18	10
118	Shoal Creek @ Crosscreek Drive	06/28/95	15	5	6	11	6	5
544	Shoal Creek @ Jefferson Drive	06/28/95	3	1	16	20	15	18
544	Shoal Creek @ Jefferson Drive	06/28/95	3	4	18	16	16	15
117	Shoal Creek @ Shoal Edge Court (EII)	06/28/95	15	18	14	20	20	16
117	Shoal Creek @ Shoal Edge Court (EII)	06/28/95	15	10	15	18	11	16
338	Shoal Creek @ Silverway	06/28/95	16	18	19	15	8	16
338	Shoal Creek @ Silverway	06/28/95	14	10	16	20	16	16
122	Shoal Creek Above 1st St.	06/28/95	13	15	1	10	16	10
122	Shoal Creek Above 1st St.	06/28/95	8	13	1	6	11	3
490	Williamson Creek @ Hwy 71 (EII)	07/07/95	18	19	10	15	18	5
490	Williamson Creek @ Hwy 71 (EII)	07/07/95	13	16	5	18	18	10
491	Williamson Creek @ IH35 (EII)	07/07/95	6	11	1	16	15	11
491	Williamson Creek @ IH35 (EII)	07/07/95	5	20	6	16	20	17
344	Williamson Creek @ Joe Tanner (EII)	07/07/95	19	12	10	18	12	18
344	Williamson Creek @ Joe Tanner (EII)	07/07/95	17	17	10	18	20	5
223	Williamson Creek @ McKinney Falls (Will1)	07/07/95	18	20	18	15	20	19
223	Williamson Creek @ McKinney Falls (Will1)	07/07/95	20	19	20	20	20	19
300	Williamson Creek @ Mowinkle (MOW)	07/07/95	20	11	17	20	19	12
300	Williamson Creek @ Mowinkle (MOW)	07/07/95	16	14	18	19	19	13
492	Williamson Creek @ Pleasant Valley (W2)	07/07/95	15	18	15	20	16	18
492	Williamson Creek @ Pleasant Valley (W2)	07/07/95	15	20	15	15	19	18

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Site #	Sample Site Name	Date	ANAEROBIC CONDITION	BANK CONDITION	BANK VEGETATION PROTECTION	CHANNEL ALTERATION	CHANNEL FLOW STATUS	DISRUPTIVE PRESSURE	EMBEDDEDNESS	FREQUENCY OF RIFFLES	INSTREAM COVER	NATIVE/EXOTIC IN AND AROUND RIPARIAN ZONE	RIPARIAN VEGETATIVE ZONE WIDTH	SEDIMENT DEPOSITION	TURBIDITY	FLOW
			Rating (1-20) Poor to Optimal												FTU	cfs
115	East Bouldin Creek @ Riverside Dr	11/23/94	18	9	7	13	13	16	8	16	16	13	5	.	4	.
119	East Bouldin Creek @ Elizabeth St	11/23/94	18	7	6	12	10	14	12	18	12	8	4	.	3	.
120	East Bouldin Creek @ South Austin Center	11/23/94	18	3	9	17	13	14	16	12	12	3	2	.	3	.
121	East Bouldin Creek @ Alpine Rd	11/23/94	14	12	10	7	16	5	8	9	12	2	2	.	5	.
123	Fort Branch Creek @ Boggy Creek	11/23/94	18	9	7	8	5	18	4	12	7	12	18	.	1	.
124	Fort Branch Creek @ MLK	11/23/94	15	3	7	11	5	17	3	13	8	12	8	.	2	.
125	Fort Branch Creek Above Manor Rd	11/23/94	18	3	7	13	17	11	4	11	12	3	4	.	3	.
126	Fort Branch Creek @ Glencrest Drive	11/23/94	13	10	12	13	17	8	11	14	17	2	3	.	2	.
116	Shoal Creek @ 24th St. (EII)	11/21/94	20	7	8	13	6	7	18	12	12	8	7	.	2	.
122	Shoal Creek Above 1st St.	11/21/94	16	11	6	8	19	15	3	13	6	13	5	.	9	.
117	Shoal Creek @ Shoal Edge Court (EII)	11/22/94	14	12	10	13	11	10	14	12	16	10	8	.	4	.
118	Shoal Creek @ Crosscreek Drive	11/22/94	13	12	10	13	16	6	14	12	12	10	3	.	6	.
336	Shoal Creek @ 31st St. (EII)	11/22/94	20	10	10	14	2	16	15	3	10	10	10	.	4	.
338	Shoal Creek @ Silverway	11/22/94	20	8	4	8	10	10	10	2	8	10	5	.	.	.
544	Shoal Creek @ Jefferson Drive	11/22/94	15	3	5	4	1	11	6	3	6	10	10	.	2	.
49	Barton Creek @ Dr. Ogletree Pool	01/04/95	17	14	15	20	20	18	20	13	18	18	15	.	0	.
78	Barton Creek @ Hwy 71 Above Little Barton	01/04/95	20	17	18	20	20	18	18	19	16	18	20	.	1	.
88	Barton Creek @ Lost Creek Bridge	01/04/95	10	8	6	20	20	20	20	20	20	18	19	.	1	.
49	Barton Creek @ Dr. Ogletree Pool	07/07/95	18	16	13	15	19	17	17	18	16	.	18	16	.	42.695
78	Barton Creek @ Hwy 71 Above Little Barton	07/07/95	18	17	12	14	18	15	17	13	12	.	10	15	.	4.734
88	Barton Creek @ Lost Creek Bridge	07/07/95	18	15	13	20	18	18	15	12	16	.	12	18	.	29.636
115	East Bouldin Creek @ Riverside Dr	06/30/95	18	6	11	15	8	18	15	16	16	.	9	8	.	0.0203
119	East Bouldin Creek @ Elizabeth St	06/30/95	18	4	8	13	12	13	13	17	7	.	11	12	.	0.627
120	East Bouldin Creek @ South Austin Center	06/30/95	18	11	9	14	11	15	13	13	13	.	10	12	.	0.2085
121	East Bouldin Creek @ Alpine Rd	06/30/95	18	15	14	12	17	6	15	11	11	.	3	16	.	0.0505

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Site #	Sample Site Name	Date	ANAEROBIC CONDITION	BANK CONDITION	BANK VEGETATION PROTECTION	CHANNEL ALTERATION	CHANNEL FLOW STATUS	DISRUPTIVE PRESSURE	EMBEDDEDNESS	FREQUENCY OF RIFFLES	INSTREAM COVER	NATIVE/EXOTIC IN AND AROUND RIPARIAN ZONE	RIPARIAN VEGETATIVE ZONE WIDTH	SEDIMENT DEPOSITION	TURBIDITY	FLOW
							Rating (1-20) Poor to Optimal								FTU	cfs
123	Fort Branch Creek @ Boggy Creek	06/30/95	19	7	10	10	8	18	2	17	5	.	18	0	.	0.2631
124	Fort Branch Creek @ MLK	06/30/95	18	6	4	14	7	18	6	17	4	.	15	2	.	0.0615
125	Fort Branch Creek Above Manor Rd	06/30/95	18	6	7	9	13	12	11	13	9	.	7	7	.	0.0991
126	Fort Branch Creek @ Glencrest Drive	06/30/95	18	15	14	13	18	6	13	14	15	.	3	13	.	0.0752
116	Shoal Creek @ 24th St. (EII)	06/26/95	20	6	5	12	5	7	16	12	5	.	8	10	.	0.065
117	Shoal Creek @ Shoal Edge Court (EII)	06/26/95	15	12	13	15	9	9	14	12	15	.	15	10	.	0.065
118	Shoal Creek @ Crosscreek Drive	06/26/95	18	18	15	14	13	7	12	13	6	.	7	18	.	0.031
122	Shoal Creek Above 1st St.	06/26/95	11	15	8	8	19	18	2	2	3	.	3	.	.	0.2031
338	Shoal Creek @ Silverway	06/26/95	18	10	5	8	13	15	18	2	5	.	5	16	.	.
544	Shoal Creek @ Jefferson Drive	06/26/95	0	2	4	2	0	17	0	0	0	.	5	8	.	.
300	Williamson Creek @ Mowinkle (MOW)	07/07/95	20	16	16	15	10	10	16	16	18	.	7	11	.	0.0256
490	Williamson Creek @ Hwy 71 (EII)	07/07/95	10	17	18	13	10	15	10	16	18	.	12	10	.	0.4524
223	Williamson Creek @ McKinney Falls	07/10/95	16	16	17	16	14	18	12	8	10	.	20	10	.	0.0117
344	Williamson Creek @ Joe Tanner (EII)	07/10/95	16	10	12	11	6	9	15	11	11	.	2	10	.	0.2242
491	Williamson Creek @ IH35 (EII)	07/10/95	14	10	13	13	9	18	4	12	7	.	10	4	.	0.156
492	Williamson Creek @ Pleasant Valley (W2)	07/10/95	16	13	12	15	10	13	12	10	13	.	10	12	.	0.5117

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Site #	Sample Site Name	Date	3,4-BENZOFLUORANTHENE	4,4'-DDD	4,4'-DDE	4,4'-DDT	ACENAPHTHENE	ACENAPHTHYLENE	ALDRIN	ALPHA-BHC	ANTHRACENE	AZINOPHOS	BENZO(A)ANTHRACENE	
			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	
53	**Barton Above Barton Springs Pool**	**11/21/94**	16543.1	746	7.6	25.3	< 625	< 625	27.9	< 1.27	724	< 57.2	12631	
53	**Barton Above Barton Springs Pool**	**11/21/94**	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
123	**Fort Branch Creek @ Boggy Creek**	**11/21/94**	< 500	33.7	6.38	4.56	< 500	< 500	3.64	< 0.91	< 500	< 5	< 500	<
123	**Fort Branch Creek @ Boggy Creek**	**11/21/94**	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
40	**Town Lake @ East Bouldin Creek**	**11/21/94**	1994.5	316	152	43.9	< 945	< 945	82	< 1.47	< 945	< 80.7	< 945	
40	**Town Lake @ East Bouldin Creek**	**11/21/94**	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
15	**Town Lake @ Shoal Creek**	**11/21/94**	1057.1	135	69.2	21.9	< 520	< 520	6.75	< 0.84	< 520	< 42.1	591.2	
15	**Town Lake @ Shoal Creek**	**11/21/94**	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.

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Site #	Sample Site Name	Date	BENZO(A)PYRENE	BENZO(G,H,I)PERYLENE	BENZO(K)FLUORANTHENE	BETA-BHC	CHLORDANE	CHLORPYRIFOS	CHRYSENE	COPPER	DELTA-BHC	DEMETON-O	DEMETON-S
			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	MG/KG	UG/KG	UG/KG	UG/KG
53	**Barton Above Barton Springs Pool**	**11/21/94**	3945.6	17980.7	11158.5	< 1.27	< 8.87	< 57.2	15551.1	9.47	559	< 57.2	< 57.2
53	**Barton Above Barton Springs Pool**	**11/21/94**	.	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
123	**Fort Branch Creek @ Boggy Creek**	**11/21/94**	500	< 500	< 500	< 0.91	< 1.82	< 5	< 500	1.7	< 0.91	< 5	< 5
123	**Fort Branch Creek @ Boggy Creek**	**11/21/94**	.	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
40	**Town Lake @ East Bouldin Creek**	**11/21/94**	1103.1	1242.9	< 945	< 1.47	< 73.2	< 80.7	< 945	22.65	20.5	< 80.7	< 80.7
40	**Town Lake @ East Bouldin Creek**	**11/21/94**	.	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .
15	**Town Lake @ Shoal Creek**	**11/21/94**	756.8	615	< 520	< 0.84	< 18.8	< 42.1	< 520	7.71	17.7	< 42.1	< 42.1
15	**Town Lake @ Shoal Creek**	**11/21/94**	.	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .

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Site #	Sample Site Name	Date	DIAZINON	DIBENZ(A,H)ANTHRACENE	DIELDRIN	ENDOSULFAN I	ENDOSULFAN II	ENDOSULFAN SULFATE	ENDRIN	ENDRIN ALDEHYDE	FLUORANTHENE	FLUORENE	GAMMA-BHC (LINDANE)	
			UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	
53	**Barton Above Barton Springs Pool**	**11/21/94**	< 57.2	6949.4	< 1.27	328	< 1.27	< 1.27	530	< 1.27	25891	< 625	17.7	
53	**Barton Above Barton Springs Pool**	**11/21/94**	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	17.7	.
123	**Fort Branch Creek @ Boggy Creek**	**11/21/94**	< 7.9	< 500	< 0.91	< 0.91	< 0.91	< 0.91	< 0.91	< 0.91	< 500	< 500	< 0.91	
123	**Fort Branch Creek @ Boggy Creek**	**11/21/94**	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	< 0.91	.
40	**Town Lake @ East Bouldin Creek**	**11/21/94**	< 80.7	< 945	65.9	20.5	< 1.47	< 1.47	< 1.47	< 1.47	1953.1	< 945	< 1.47	
40	**Town Lake @ East Bouldin Creek**	**11/21/94**	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	< 1.47	.
15	**Town Lake @ Shoal Creek**	**11/21/94**	< 42.1	< 520	69.2	5.91	< 0.84	< 0.84	< 0.84	< 0.84	1324.2	< 520	< 0.84	
15	**Town Lake @ Shoal Creek**	**11/21/94**	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	< 0.84	.

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Site #	Sample Site Name	Date	HEPTACHLOR	HEPTACHLOR EPOXIDE	INDENO(1,2,3-CD)PYRENE	LEAD	MALATHION	MERCURY	METHOXYCHLOR	NAPHTHALENE	OIL AND GREASE	PARATHION	PHENANTHRENE	
			UG/KG	UG/KG	UG/KG	MG/KG	UG/KG	MG/KG	UG/KG	UG/KG	MG/KG	UG/KG	UG/KG	
53	Barton Above Barton Springs Pool	11/21/94	232	5.07	17215.7	20.76	< 57.2	< 0.8	< 1.27	< 625	3.7	< 57.2	6955.7	<
53	Barton Above Barton Springs Pool	11/21/94	.	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
123	Fort Branch Creek @ Boggy Creek	11/21/94	66.5	< 0.91	< 500	2.78	< 5	< 0.8	< 0.91	< 500	1.1	< 5	< 500	<
123	Fort Branch Creek @ Boggy Creek	11/21/94	.	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
40	Town Lake @ East Bouldin Creek	11/21/94	130	< 1.47	< 945	76.12	< 80.7	< 0.8	< 1.47	< 945	10.5	< 80.7	< 945	<
40	Town Lake @ East Bouldin Creek	11/21/94	.	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.
15	Town Lake @ Shoal Creek	11/21/94	198	< 0.84	< 520	53.73	< 42.1	< 0.8	< 0.84	< 520	5.3	< 42.1	577.7	<
15	Town Lake @ Shoal Creek	11/21/94	.	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	.

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Site #	Sample Site Name	Date	POLYCHLORINATED BIPHENYL	PYRENE	TEXTURE,CLAY	TEXTURE,SAND	TEXTURE,SILT	TOTAL PETROLEUM HYDROCARBONS	TOXAPHENE	ZINC	EII SEDIMENT QUALITY RATING
			UG/KG	UG/KG	(%) Percent	(%) Percent	(%) Percent	MG/KG	UG/KG	MG/KG	Rating
53	**Barton Above Barton Springs Pool**	**11/21/94**	25.3	25346.9	20.17	22.4	36.8	199	< 63.4	56.7	43
53	**Barton Above Barton Springs Pool**	**11/21/94**	.	. .	. .	. .	. .	. .	. .	. .	. .
123	**Fort Branch Creek @ Boggy Creek**	**11/21/94**	1.9	< 500	. .	. .	. .	55.9	109	10.13	81
123	**Fort Branch Creek @ Boggy Creek**	**11/21/94**	.	. .	. .	. .	. .	. .	. .	. .	. .
40	**Town Lake @ East Bouldin Creek**	**11/21/94**	22	2274.2	. .	. .	. .	837.7	< 147	134.08	46
40	**Town Lake @ East Bouldin Creek**	**11/21/94**	.	. .	. .	. .	. .	. .	. .	. .	. .
15	**Town Lake @ Shoal Creek**	**11/21/94**	15.3	1543.7	. .	. .	. .	335.3	< 84.4	47.77	53
15	**Town Lake @ Shoal Creek**	**11/21/94**	.	. .	. .	. .	. .	. .	. .	. .	. .

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Site #	Sample Site Name	Date		AMMONIA AS N MG/L		FECAL COLIFORM BACTERIA Colonies/100ML	NITRATE AS N MG/L	ORTHO-PHOS-PHORUS AS P MG/L	TOTAL DISSOLVED SOLIDS MG/L		TOTAL SUSPENDED SOLIDS MG/L
53	Barton Creek Above Barton Springs Pool	11/23/94	<	0.01		20	1.4	0.03	300		0.4
53	Barton Creek Above Barton Springs Pool	11/23/94		0.01		10	1.4	0.03	300		12.8
53	Barton Creek Above Barton Springs Pool	11/23/94	<	0.01	.	.	1.1	0.02	.	.	.
53	Barton Creek Above Barton Springs Pool	11/23/94	<	0.01	.	.	1.1	0.02	.	.	.
78	Barton Creek @ Hwy 71 Above Little Barton	11/23/94	<	0.01		30	0.07	0.02	280		0.8
78	Barton Creek @ Hwy 71 Above Little Barton	11/23/94		0.14		20	0.07	0.02	280		1
88	Barton Creek @ Lost Creek Bridge	11/23/94	<	0.01		10	1.2	0.02	290		1
88	Barton Creek @ Lost Creek Bridge (BC10)	11/23/94	<	0.01		280	1.2	0.03	290		0.6
115	East Bouldin Creek @ Riverside Dr	11/23/94	<	0.01		420	2.7	0.06	530		2.4
115	East Bouldin Creek @ Riverside Dr	11/23/94	<	0.01		770	2.3	0.06	520		0.8
115	East Bouldin Creek @ Riverside Dr	11/23/94		0.01	.	.	2.3	0.04	.	.	.
115	East Bouldin Creek @ Riverside Dr	11/23/94		0.01	.	.	2.3	0.02	.	.	.
116	Shoal Creek @ 24th St. (EII)	11/23/94		0.04		50	1.3	0.04	470		2.6
116	Shoal Creek @ 24th St. (EII)	11/23/94		0.03		10	1.3	0.04	470		3.4
117	Shoal Creek @ Shoal Edge Court (EII)	11/23/94	<	0.01		510	0.5	0.03	380		0.6
117	Shoal Creek @ Shoal Edge Court (EII)	11/23/94	<	0.01		10	0.5	0.03	380		0.2
118	Shoal Creek @ Crosscreek Drive	11/23/94	<	0.01		410	0.06	0.05	310		8
118	Shoal Creek @ Crosscreek Drive	11/23/94	<	0.01		30	0.06	0.05	320		1.6
119	East Bouldin Creek @ Elizabeth St	11/23/94		0.02		580	0.1	0.09	430		8.3
119	East Bouldin Creek @ Elizabeth St	11/23/94	<	0.01		530	0.1	0.08	430		0.8
120	East Bouldin Creek @ South Austin Center	11/23/94	<	0.01		910	0.7	0.06	320		0.2
120	East Bouldin Creek @ South Austin Center	11/23/94	<	0.01		980	0.7	0.07	310		0.4
121	East Bouldin Creek @ Alpine Rd	11/23/94	<	0.01		740	4	0.06	340		7
121	East Bouldin Creek @ Alpine Rd	11/23/94	<	0.01		860	4.2	0.06	330		6.6
122	Shoal Creek Above 1st St.	11/23/94		0.23		4180	1.9	0.29	410		2.6
122	Shoal Creek Above 1st St.	11/23/94		0.25		3020	1.9	0.3	410		2.8
122	Shoal Creek Above 1st St.	11/23/94		0.24	.	.	1.9	0.3	.	.	.
122	Shoal Creek Above 1st St.	11/23/94		0.24	.	.	2	0.29	.	.	.
123	Fort Branch Creek @ Boggy Creek	11/23/94	<	0.01		40	0.07	0.03	390		1.6
123	Fort Branch Creek @ Boggy Creek	11/23/94	<	0.01		40	0.08	0.03	390		0.6

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Site #	Sample Site Name	Date		AMMONIA AS N MG/L		FECAL COLIFORM BACTERIA Colonies/100ML		NITRATE AS N MG/L	ORTHO-PHOS-PHORUS AS P MG/L	TOTAL DISSOLVED SOLIDS MG/L		TOTAL SUSPENDED SOLIDS MG/L
123	**Fort Branch Creek @ Boggy Creek**	**11/23/94**	<	0.01	.	.	<	0.1	0.03	.	.	.
123	**Fort Branch Creek @ Boggy Creek**	**11/23/94**	<	0.01	.	.	<	0.1	0.04	.	.	.
124	**Fort Branch Creek @ MLK**	**11/23/94**	<	0.01		20		0.5	0.06	570		1.6
124	**Fort Branch Creek @ MLK**	**11/23/94**	<	0.01		50		0.4	0.05	560		0.8
125	**Fort Branch Creek Above Manor Rd**	**11/23/94**	<	0.01		80		0.08	0.03	390		0.8
125	**Fort Branch Creek Above Manor Rd**	**11/23/94**	<	0.01		100		0.07	0.03	390		1.4
126	**Fort Branch Creek @ Glencrest Drive**	**11/23/94**	<	0.01		950		0.9	0.04	400		0.8
126	**Fort Branch Creek @ Glencrest Drive**	**11/23/94**	<	0.01		630		0.9	0.04	400		1
53	**Barton Creek Above Barton Springs Pool**	**06/27/95**	<	0.01		307		0.2	0.02	265		1.2
78	**Barton Creek @ Hwy 71 Above Little Barton**	**06/27/95**		0.01		20	<	0.1	0.02	250	<	0.5
88	**Barton Creek @ Lost Creek Bridge (BC10)**	**06/27/95**		0.02		15	<	0.1	0.03	264		0.5
115	**East Bouldin Creek @ Riverside Dr**	**06/27/95**		0.02		1580		3.6	0.06	502		2.3
116	**Shoal Creek @ 24th St. (EII)**	**06/27/95**		0.24		840		2	0.03	438		1
117	**Shoal Creek @ Shoal Edge Court (EII)**	**06/27/95**		0.75	>	10000		1.5	0.22	285		15.4
118	**Shoal Creek @ Crosscreek Drive**	**06/27/95**		0.01		195		0.1	0.02	230		1.3
119	**East Bouldin Creek @ Elizabeth St**	**06/27/95**	<	0.01		752		1.1	0.07	392		4
120	**East Bouldin Creek @ South Austin Center**	**06/27/95**	<	0.01		1284		1.7	0.04	386		3.2
121	**East Bouldin Creek @ Alpine Rd**	**06/27/95**	<	0.01		1500		3.7	0.03	288		2
122	**Shoal Creek Above 1st St.**	**06/27/95**		0.05		756		1.5	0.12	494		3.2
123	**Fort Branch Creek @ Boggy Creek**	**06/27/95**		0.02		259		0.1	0.08	394		1
124	**Fort Branch Creek @ MLK**	**06/27/95**		0.05		203		0.1	0.08	332		1.8
125	**Fort Branch Creek Above Manor Rd**	**06/27/95**		0.11		160		0.2	0.09	216		1.5
126	**Fort Branch Creek @ Glencrest Drive**	**06/27/95**		0.04	<	1		0.6	0.15	320		2.9
300	**Williamson Creek @ Mowinkle (MOW)**	**06/27/95**	<	0.01		6	<	0.1	0.03	407	<	0.5
344	**Williamson Creek @ Joe Tanner (EII)**	**06/27/95**		0.03		732		0.1	0.02	228		3.2
490	**Williamson Creek @ Hwy 71 (EII)**	**06/27/95**		0.01		190		0.3	0.06	300		5.2
223	**Williamson Creek @ McKinney Falls**	**07/07/95**		0.05		120		0.8	0.05	302		10.9
491	**Williamson Creek @ IH35 (EII)**	**07/07/95**		0.01		246		0.2	0.04	305		19.9
492	**Williamson Creek @ Pleasant Valley (W2)**	**07/07/95**		0.01		108		0.2	0.04	298		2.1

Appendix D - 1994,1995 Benthic Macroinvertebrate Data
(Counts)

Site #	Sample Site Name	Date	ACHNANTHES AMOENA	ACHNANTHES CURTISSIMA	ACHNANTHES EXIGUA	ACHNANTHES GRISCHUNA	ACHNANTHES LANCEOLATA	ACHNANTHES MINUTISSIMA	ACHNANTHES SUBATOMOIDES	AMPHIPLEURA PELLUCIDA	AMPHORA LIBYCA	AMPHORA MONTANA	AMPHORA PEDICULUS	AMPHORA VENETA	ANOMOENEIS BRACHYSIRA	ANOMONEIS VITREA	CALONEIS BACILLUM	CALONEIS MOLARIS	CALONEIS SCHUMANNIANA	CALONEIS SILICULA	COCCONEIS PLACENTULA	CYMBELLA AFFINIS	CYMBELLA BREHMII	CYMBELLA CYMBIFORMIS	CYMBELLA DELICATULA	CYMBELLA GRACILIS	CYMBELLA MICROCEPHALA	CYMBELLA MINUTA	CYMBELLA SILESIACA	CYMBELLA TUMIDULA
.	.	.																												
53	Barton Above Barton Springs Pool	11/28/94	.	.	.	.	.	351.5	.	.	.	.	.	.	.	4	.	.	1	.	.	2	.	.	.	.	2	.	.	.
78	Barton @ 71 Above Little Barton	11/28/94	.	.	.	.	.	120	.	4	.	.	.	.	4	66	.	.	.	.	.	.	2	2	.	.	48	208	.	.
88	Barton Creek @ Lost Creek Bridge	11/28/94	.	.	2	.	2	312	.	.	.	.	6	.	.	4	.	.	.	.	.	.	.	.	20	.	30	6	4	2
115	East Bouldin Creek @ Riverside Dr	11/21/94	2	.	.	.	8	.	.	.	.	42	26	.	.	.	.	2	.	2	.	4	.	.	2	.	.	.	.	.
116	Shoal Creek @ 24th St. (EII)	11/18/94	.	.	.	.	.	2	.	2	.	.	.	.	.	.	2	.	.	.	.	34	.	.	.	.	.	44	42	.
117	Shoal Creek @ Shoal Edge Court	11/18/94	.	.	2	2	.	14	34	.	.	2	6	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	12	.
118	Shoal Creek @ Crosscreek Drive	11/18/94	.	.	2	16	.	.	38	1	.	8	2	.	.	.	.	.	.	.	.	2	.	.	.	.	.	.	6	.
119	East Bouldin Creek @ Elizabeth St	11/21/94	.	2	2	24	.	18	24	.	.	12	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
120	East Bouldin @ South Austin Center	11/21/94	.	.	4	.	4	16	.	.	4	30	2	.	.	2	.	8	.	.	2	.	.	2	4	2	2	.	.	.
121	East Bouldin Creek @ Alpine Rd	11/21/94	.	.	.	.	.	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.
122	Shoal Creek Above 1st St.	11/18/94	.	.	.	6	.	4	.	.	.	6	.	2	.	.	.	.	.	.	.	12	.	.	.	.	.	4	24	.
123	Fort Branch Creek @ Boggy Creek	11/18/94	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.	.	.	.	.	14	.
124	Fort Branch Creek @ MLK	11/18/94	.	.	4	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
125	Fort Branch Creek Above Manor Rd	11/18/94	.	.	.	.	.	16	.	.	.	10	.	.	.	.	.	4	.	.	.	8	.	.	2	.	4	.	2	.
126	Fort Branch Creek @ Glencrest Dr	11/18/94	.	.	.	20	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Appendix D - 1994,1995 Benthic Macroinvertebrate Data
(Counts)

Site #	Sample Site Name	Date	CYMBELLA TURGIDULA	DIPLONEIS OVALIS	EUNOTIA BILUNARIS	FRAGILARIA CAPUCINA	FRAGILARIA DELICATISSIMA	FRAGILARIA ULNA	GOMPHONEMA DICHOTOMUM	GOMPHONEMA PARVULUM	GYROSIGMA SCALPROIDES	HANTZSCHIA AMPHIOXYS	MASTOGLOIA SMITHII	MELOSIRA LINEATA	NAVICULA ABSOLUTA	NAVICULA ANGUSTA	NAVICULA ARVENSIS	NAVICULA ATOMUS	NAVICULA CINCTA	NAVICULA CRYPTOCEPHALA	NAVICULA CRYPTOTENELLA	NAVICULA DECUSSIS	NAVICULA ERIFUGA	NAVICULA GOEPPERTIANA	NAVICULA HALOPHILA	NAVICULA INGENUA	NAVICULA KRIEGERII	NAVICULA LANCEOLATA	NAVICULA MENISCULUS	NAVICULA MINIMA
53	**Barton Above Barton Springs Pool**	**11/28/94**	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	5
78	**Barton @ 71 Above Little Barton**	**11/28/94**	.	.	.	.	.	2	6	.	.	.	8	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
88	**Barton Creek @ Lost Creek Bridge**	**11/28/94**	.	.	.	.	.	.	.	6	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	77.5	.	2	.
115	**East Bouldin Creek @ Riverside Dr**	**11/21/94**	.	.	.	.	2	.	.	14	.	.	.	.	6	.	.	28	.	4	2	.	.	2	.	16	.	12	10	20
116	**Shoal Creek @ 24th St. (EII)**	**11/18/94**	4	.	.	13	.	.	.	14	.	.	.	8	2	.	.	.	8	42	.	.	.	.	.	.	.	.	.	.
117	**Shoal Creek @ Shoal Edge Court**	**11/18/94**	.	.	.	.	.	.	.	14	.	.	.	.	.	.	2	.	6	14	.	.	6	.	.	.	.	.	.	.
118	**Shoal Creek @ Crosscreek Drive**	**11/18/94**	.	.	.	2	.	.	.	2	.	.	.	.	.	.	14	.	2	8	4	.	.	.	.	.	.	.	.	.
119	**East Bouldin Creek @ Elizabeth St**	**11/21/94**	.	.	.	.	.	.	.	2	.	4	.	.	.	.	16	24	.	.	.	.	8	.	.	.	.	.	2	.
120	**East Bouldin @ South Austin Center**	**11/21/94**	.	.	.	.	.	.	.	38	.	.	.	8	.	.	.	.	.	.	.	.	.	2	.	2	.	.	.	16
121	**East Bouldin Creek @ Alpine Rd**	**11/21/94**	.	.	.	.	.	.	.	2	.	.	.	.	6	.	.	2	.	.	.	.	.	.	.	.	.	6	.	.
122	**Shoal Creek Above 1st St.**	**11/18/94**	.	.	.	4	.	.	.	2	.	.	.	4	.	.	.	20	.	14	24	.	.	.	.	2	.	4	3.5	10
123	**Fort Branch Creek @ Boggy Creek**	**11/18/94**	.	.	.	.	.	.	.	.	.	.	.	.	.	26	.	24	.	8	20	2	.	.	.	.	.	.	.	.
124	**Fort Branch Creek @ MLK**	**11/18/94**	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16	8	14	42	.	.	.	.	.	.	.	.	.
125	**Fort Branch Creek Above Manor Rd**	**11/18/94**	.	.	.	33	.	.	.	30	.	.	.	.	.	.	.	4	54	16	8	.	.	.	.	.	.	.	.	.
126	**Fort Branch Creek @ Glencrest Dr**	**11/18/94**	.	4	2	.	.	.	.	2	2	.	.	.	12	.	4	22	.	6	28	.	42	2	.	.	.	.	.	.

Appendix D - 1994,1995 Benthic Macroinvertebrate Data
(Counts)

Site #	Sample Site Name	Date	NAVICULA MINUSCULA	NAVICULA MONOCULATA	NAVICULA PSEUDANGLICA	NAVICULA PUPULA	NAVICULA PYGMAEA	NAVICULA RADIOSA	NAVICULA REICHARDTIANA	NAVICULA SCHROETERII	NAVICULA SP. 3	NAVICULA SP. 4	NAVICULA SP. 5	NAVICULA SP.1	NAVICULA SP.2	NAVICULA STROEMII	NAVICULA SUBMINISCULA	NAVICULA SUBTILISSIMA	NAVICULA TEXANA	NAVICULA TRIDENTULA	NAVICULA VENETA	NAVICULA VIRIDULA	NEIDIUM AMPLIATUM	NITZSCHIA ACICULARIS	NITZSCHIA AGNITA	NITZSCHIA AMPHIBIA	NITZSCHIA AMPHIBIOIDES	NITZSCHIA CLAUSII	NITZSCHIA CONSTRICTA	NITZSCHIA DISSIPATA
53	Barton Above Barton Springs Pool	11/28/94	.	.	.	.	.	.	.	.	.	10	.	4	.	.	.	.	.	.	.	.	.	.	.	90.5	.	.	.	.
78	Barton @ 71 Above Little Barton	11/28/94	.	.	.	.	.	8	.	.	2	.	.	2	4	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.
88	Barton Creek @ Lost Creek Bridge	11/28/94	.	.	.	.	.	8	.	.	6	.	.	6	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.
115	East Bouldin Creek @ Riverside Dr	11/21/94	22	.	.	28	.	.	.	.	.	.	.	.	.	14	2	2	8	.	.	2	.	.	4	94	.	.	6	.
116	Shoal Creek @ 24th St. (EII)	11/18/94	4	36	.	.	.	.	.	10	.	.	.	.	.	.	6	.	.	.	.	2	.	.	.	.	.	46	2	.
117	Shoal Creek @ Shoal Edge Court	11/18/94	2	4	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	6	.	.	.	.	2	.	.	15	4	.
118	Shoal Creek @ Crosscreek Drive	11/18/94	38	14	.	2	.	.	.	4	.	.	.	.	.	.	12	.	.	.	.	2	.	.	.	50	.	6	.	.
119	East Bouldin Creek @ Elizabeth St	11/21/94	68	4	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	4	2	2	.	.	142	.	10	2	.
120	East Bouldin @ South Austin Center	11/21/94	.	.	.	4	.	.	.	.	.	.	14	.	.	.	.	.	.	.	.	26	.	2	14	151	2	.	2	.
121	East Bouldin Creek @ Alpine Rd	11/21/94	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	126	4	4
122	Shoal Creek Above 1st St.	11/18/94	197	.	.	4	2	2	.	.	.	.	.	.	.	.	.	2	.	.	.	4	.	4	.	30	.	.	.	.
123	Fort Branch Creek @ Boggy Creek	11/18/94	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14	.	4	2	66	.	.	4	6
124	Fort Branch Creek @ MLK	11/18/94	.	30	.	.	.	.	.	.	.	.	.	.	.	.	10	.	.	.	.	.	.	.	.	44	.	41	.	.
125	Fort Branch Creek Above Manor Rd	11/18/94	.	6	.	.	.	.	.	14	.	.	.	.	.	.	4	.	.	.	.	47	.	.	.	32	.	105	.	.
126	Fort Branch Creek @ Glencrest Dr	11/18/94	.	56	2	.	.	.	4	.	.	.	.	.	.	.	6	.	.	.	.	54	.	.	.	62	.	4	.	6

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(Counts)

Site #	Sample Site Name	Date	NITZSCHIA FILIFORMIS	NITZSCHIA FRUSTULUM	NITZSCHIA GRACILIFORMIS	NITZSCHIA INCONSPICUA	NITZSCHIA LIBERTRUTHII	NITZSCHIA LINEARIS	NITZSCHIA MICROCEPHALA	NITZSCHIA NANA	NITZSCHIA PALEA	NITZSCHIA PALEACEA	NITZSCHIA PELLUCIDA	NITZSCHIA PUMILA	NITZSCHIA SCALPELLIFORMIS	NITZSCHIA SP. 2	PINNULARIA GIBBA	PINNULARIA STOMATOPHORA	STAURONEIS SP.1	STEPHANODISCUS PARVUS	SURIRELLA ANGUSTA	SURIRELLA PATTELLA
.	.	.																				
53	**Barton Above Barton Springs Pool**	**11/28/94**	.	.	.	.	.	.	.	.	20	.	.	.	.	.	.	.	.	.	.	.
78	**Barton @ 71 Above Little Barton**	**11/28/94**	.	.	.	.	.	.	.	.	14	.	.	4	.	4	.	2	2	.	.	.
88	**Barton Creek @ Lost Creek Bridge**	**11/28/94**	.	.	.	.	.	.	2	.	2	2	.	2	.	.	.	.	.	.	.	.
115	**East Bouldin Creek @ Riverside Dr**	**11/21/94**	.	.	.	.	.	26	.	20	58	.	.	.	2	.	.	.	.	4	4	.
116	**Shoal Creek @ 24th St. (EII)**	**11/18/94**	6	40	.	.	.	7	8	.	74	.	.	.	.	.	.	.	.	24	14	4
117	**Shoal Creek @ Shoal Edge Court**	**11/18/94**	.	206	.	110	.	2	2	.	20	.	.	.	.	.	.	.	.	6	4	.
118	**Shoal Creek @ Crosscreek Drive**	**11/18/94**	.	2	2	.	.	.	34	4	223	.	.	.	.	.	.	.	.	.	.	.
119	**East Bouldin Creek @ Elizabeth St**	**11/21/94**	.	.	.	.	.	13	.	.	99	.	.	.	.	.	.	.	.	4	4	.
120	**East Bouldin @ South Austin Center**	**11/21/94**	.	.	.	.	4	28	.	18	62	.	.	.	.	.	.	.	.	2	25	.
121	**East Bouldin Creek @ Alpine Rd**	**11/21/94**	.	.	.	.	.	106	.	8	132	.	.	.	.	.	.	.	.	.	78	.
122	**Shoal Creek Above 1st St.**	**11/18/94**	.	.	.	.	.	.	.	8	102	.	.	.	.	.	.	.	.	.	.	.
123	**Fort Branch Creek @ Boggy Creek**	**11/18/94**	.	.	.	.	.	33	.	4	257	.	.	.	.	.	.	.	.	.	5	.
124	**Fort Branch Creek @ MLK**	**11/18/94**	.	.	.	.	.	.	10	.	273	.	.	.	.	.	.	.	.	2	2	.
125	**Fort Branch Creek Above Manor Rd**	**11/18/94**	2	.	.	.	.	2	.	4	70	.	4	.	.	.	.	.	.	2	18	.
126	**Fort Branch Creek @ Glencrest Dr**	**11/18/94**	.	.	.	.	.	4	.	41	107	.	.	.	.	.	2	.	.	.	4	.

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	ACHNANTHES AMOENA	ACHNANTHES CURTISSIMA	ACHNANTHES DELICATULA	ACHNANTHES EXIGUA	ACHNANTHES GRISCHUNA	ACHNANTHES LANCEOLATA	ACHNANTHES MINUTISSIMA	ACHNANTHES SUBATOMOIDES	AMPHIPLEURA PELLUCIDA	AMPHORA LIBYCA	AMPHORA MONTANA	AMPHORA PEDICULUS	AMPHORA VENETA	ANOMOENEIS BRACHYSIRA	ANOMONEIS VITREA	CALONEIS BACILLUM	CALONEIS MOLARIS	CALONEIS SCHUMANNIANA	CALONEIS SILICULA	COCCONEIS PLACENTULA	CYCLOTELLA MENENGHINIANA	CYMBELLA AFFINIS	CYMBELLA AMPHICEPHALA	CYMBELLA BREHMII	CYMBELLA CISTULA
78	Barton @ 71 Above Little Barton	11/28/94							120		4					4	66									2	
88	Barton Creek @ Lost Creek Bridge	11/28/94				2		2	312					6			4										
53	Barton Above Barton Springs Pool	11/28/94							351								4			1				2			
121	East Bouldin @ Alpine Rd	11/21/94									8																
119	East Bouldin @ Elizabeth St	11/21/94		2		2	24		18	24			12	6													
115	East Bouldin @ Riverside Dr	11/21/94	2					8					42	26					2		2			4			
120	East Bouldin @ S. Austin Center	11/21/94				4		4	16			4	30	2			2		8			2					
123	Fort Branch @ Boggy Creek	11/18/94				6																		6			
126	Fort Branch @ Glencrest Dr	11/18/94					20						4														
124	Fort Branch Creek @ MLK	11/18/94				4			4																		
125	Fort Branch Above Manor Rd	11/18/94							16				10						4					8			
116	Shoal Creek @ 24th St. (EII)	11/18/94							2		2							2						34			
118	Shoal Creek @ Crosscreek Drive	11/18/94				2	16			38	1		8	2										2			
117	Shoal Creek @ Shoal Edge Court	11/18/94				2	2		14	34			2	6										4			
122	Shoal Creek Above 1st St.	11/18/94					6		4				6		2									12			

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	ACHNANTHES AMOENA	ACHNANTHES CURTISSIMA	ACHNANTHES DELICATULA	ACHNANTHES EXIGUA	ACHNANTHES GRISCHUNA	ACHNANTHES LANCEOLATA	ACHNANTHES MINUTISSIMA	ACHNANTHES SUBATOMOIDES	AMPHIPLEURA PELLUCIDA	AMPHORA LIBYCA	AMPHORA MONTANA	AMPHORA PEDICULUS	AMPHORA VENETA	ANOMOENEIS BRACHYSIRA	ANOMOENEIS VITREA	CALONEIS BACILLUM	CALONEIS MOLARIS	CALONEIS SCHUMANNIANA	CALONEIS SILICULA	COCCONEIS PLACENTULA	CYCLOTELLA MENENGHINIANA	CYMBELLA AFFINIS	CYMBELLA AMPHICEPHALA	CYMBELLA BREHMII	CYMBELLA CISTULA
78	**Barton @ 71 Above Little Barton**	**06/29/95**							204					2			90					2			26		
88	**Barton Creek @ Lost Creek Bridge**	**06/29/95**							178		84			28			60					6					
53	**Barton Above Barton Springs Pool**	**06/29/95**							169		2					2	40					6	4	10			
121	**East Bouldin Creek @ Alpine Rd**	**06/27/95**							22				2	2					8								
119	**East Bouldin @ Elizabeth St**	**06/27/95**				4		18	254					6								16					
115	**East Bouldin @ Riverside**	**06/27/95**						2	70				6	180									4				
120	**East Bouldin @ S. Austin Center**	**06/27/95**			22			16	176					34									6				
124	**Fort Branch Creek @ MLK**	**06/27/95**				18			124				2										4	44			
123	**Fort Branch @ Boggy Creek**	**06/29/95**				24		16	54				2			2		12		2			6	42			
126	**Fort Branch @ Glencrest Dr**	**06/29/95**				10	48	2	76					100									4				
125	**Fort Branch Above Manor Rd**	**06/29/95**				24		2	74		2		22	4							4		8	6			
116	**Shoal Creek @ 24th St. (EII)**	**06/26/95**							120				2										14	82			
118	**Shoal Creek @ Crosscreek Dr**	**06/26/95**				14			272				2										10				
117	**Shoal Creek @ Shoal Edge Ct**	**06/26/95**							372					28									4				
122	**Shoal Creek Above 1st St.**	**06/26/95**							34				2	4									36	28			
490	**Williamson Creek @ Hwy 71**	**06/28/95**				2		12	80		22			42								18	2				
344	**Williamson Creek @ Joe Tanner**	**06/28/95**							166					4			4					2		8			2
300	**Williamson Creek @ Mowinkle**	**06/28/95**							294					22								34					
492	**Williamson @ Pleasant Valley**	**06/30/95**					28		170				2	8							4	4		24			
491	**Williamson Creek @ IH35**	**07/07/95**				4			180					26								4					
223	**Williamson @ McKinney Falls**	**07/07/95**						2	140					36								2		6			

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	CYMBELLA CYMBIFORMIS	CYMBELLA DELICATULA	CYMBELLA GRACILIS	CYMBELLA MICROCEPHALA	CYMBELLA MINUTA	CYMBELLA SILESIACA	CYMBELLA TUMIDULA	CYMBELLA TURGIDULA	DENTICULA KUETZINGII	DIATOMA VULGARIS	DIPLONEIS ELLIPTICA	DIPLONEIS OVALIS	EUNOTIA BILUNARIS	EUNOTIA MINOR	FRAGILARIA CAPUCINA	FRAGILARIA DELICATISSIMA	FRAGILARIA ULNA	GOMPHONEMA ANGUSTUM	GOMPHONEMA DICHOTOMUM	GOMPHONEMA GROVEI	GOMPHONEMA MINUTUM	GOMPHONEMA PARVULUM	GOMPHONEMA PSEUDOAUGUR	GOMPHONEMA SP. 1	GOMPHONEMA TRUNCATUM
78	**Barton @ 71 Above Little Barton**	**11/28/94**	2			48	208												2		6						
88	**Barton Creek @ Lost Creek Bridge**	**11/28/94**		20		30	6	4	2															6			
53	**Barton Above Barton Springs Pool**	**11/28/94**				2																		2			
121	**East Bouldin @ Alpine Rd**	**11/21/94**						6																2			
119	**East Bouldin @ Elizabeth St**	**11/21/94**																						2			
115	**East Bouldin @ Riverside Dr**	**11/21/94**		2														2						14			
120	**East Bouldin @ S. Austin Center**	**11/21/94**	2	4	2	2																		38			
123	**Fort Branch @ Boggy Creek**	**11/18/94**						14																			
126	**Fort Branch @ Glencrest Dr**	**11/18/94**												4	2									2			
124	**Fort Branch Creek @ MLK**	**11/18/94**																									
125	**Fort Branch Above Manor Rd**	**11/18/94**		2		4		2									33							30			
116	**Shoal Creek @ 24th St. (EII)**	**11/18/94**					44	42		4							13							14			
118	**Shoal Creek @ Crosscreek Drive**	**11/18/94**						6									2							2			
117	**Shoal Creek @ Shoal Edge Court**	**11/18/94**						12																14			
122	**Shoal Creek Above 1st St.**	**11/18/94**					4	24									4							2			

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	CYMBELLA CYMBIFORMIS	CYMBELLA DELICATULA	CYMBELLA GRACILIS	CYMBELLA MICROCEPHALA	CYMBELLA MINUTA	CYMBELLA SILESIACA	CYMBELLA TUMIDULA	CYMBELLA TURGIDULA	DENTICULA KUETZINGII	DIATOMA VULGARIS	DIPLONEIS ELLIPTICA	DIPLONEIS OVALIS	EUNOTIA BILUNARIS	EUNOTIA MINOR	FRAGILARIA CAPUCINA	FRAGILARIA DELICATISSIMA	FRAGILARIA ULNA	GOMPHONEMA ANGUSTUM	GOMPHONEMA DICHOTOMUM	GOMPHONEMA GROVEI	GOMPHONEMA MINUTUM	GOMPHONEMA PARVULUM	GOMPHONEMA PSEUDOAUGUR	GOMPHONEMA SP. 1	GOMPHONEMA TRUNCATUM
78	**Barton @ 71 Above Little Barton**	**06/29/95**		66		34	8	10	14											8				2			
88	**Barton Creek @ Lost Creek Bridge**	**06/29/95**			14	44			20															6			
53	**Barton Above Barton Springs Pool**	**06/29/95**		126		28	8		46		4		2			2				6				4			
121	**East Bouldin Creek @ Alpine Rd**	**06/27/95**						10																8			
119	**East Bouldin @ Elizabeth St**	**06/27/95**						10																34			
115	**East Bouldin @ Riverside**	**06/27/95**						6																16			
120	**East Bouldin @ S. Austin Center**	**06/27/95**															2							8			
124	**Fort Branch Creek @ MLK**	**06/27/95**					4	6				2					20							4			
123	**Fort Branch @ Boggy Creek**	**06/29/95**						16																6			
126	**Fort Branch @ Glencrest Dr**	**06/29/95**											10									2		4			
125	**Fort Branch Above Manor Rd**	**06/29/95**					2	4			2													4			
116	**Shoal Creek @ 24th St. (EII)**	**06/26/95**					6	94	4										8					66	4		
118	**Shoal Creek @ Crosscreek Dr**	**06/26/95**						14									8							28		6	
117	**Shoal Creek @ Shoal Edge Ct**	**06/26/95**						4																8			
122	**Shoal Creek Above 1st St.**	**06/26/95**		2				64		8		2												32			
490	**Williamson Creek @ Hwy 71**	**06/28/95**											6									4		2			
344	**Williamson Creek @ Joe Tanner**	**06/28/95**					8	14			132		2											2			
300	**Williamson Creek @ Mowinkle**	**06/28/95**										6											12				
492	**Williamson @ Pleasant Valley**	**06/30/95**					14	14																8			2
491	**Williamson Creek @ IH35**	**07/07/95**																									
223	**Williamson @ McKinney Falls**	**07/07/95**					8	8																4			2

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	GYROSIGMA SCALPROIDES	HANTZSCHIA AMPHIOXYS	MASTOGLOIA SMITHII	MELOSIRA LINEATA	NAVICULA ABSOLUTA	NAVICULA ACCOMODA	NAVICULA ANGUSTA	NAVICULA ARVENSIS	NAVICULA ATOMUS	NAVICULA BACILLOIDES	NAVICULA CINCTA	NAVICULA CRYPTOCEPHALA	NAVICULA CRYPTOTENELLA	NAVICULA DECUSSIS	NAVICULA ELGINENSIS	NAVICULA ERIFUGA	NAVICULA GOEPPERTIANA	NAVICULA HALOPHILA	NAVICULA INGENUA	NAVICULA KRIEGERII	NAVICULA LANCEOLATA	NAVICULA LONGICEPHALA	NAVICULA MENISCULUS	NAVICULA MINIMA	NAVICULA MINUSCULA
78	**Barton @ 71 Above Little Barton**	**11/28/94**			8																						
88	**Barton Creek @ Lost Creek Bridge**	**11/28/94**																				78			2		
53	**Barton Above Barton Springs Pool**	**11/28/94**																		10						5	
121	**East Bouldin @ Alpine Rd**	**11/21/94**					6				2												6				
119	**East Bouldin @ Elizabeth St**	**11/21/94**		4						16	24							8							2		68
115	**East Bouldin @ Riverside Dr**	**11/21/94**					6				28			4	2				2		16		12		10	20	22
120	**East Bouldin @ S. Austin Center**	**11/21/94**				8													2		2					16	
123	**Fort Branch @ Boggy Creek**	**11/18/94**							26		24			8	20	2											
126	**Fort Branch @ Glencrest Dr**	**11/18/94**	2				12			4	22			6	28			42	2								
124	**Fort Branch Creek @ MLK**	**11/18/94**									16		8	14	42												
125	**Fort Branch Above Manor Rd**	**11/18/94**									4		54	16	8												
116	**Shoal Creek @ 24th St. (EII)**	**11/18/94**				8	2						8	42													4
118	**Shoal Creek @ Crosscreek Drive**	**11/18/94**								14			2	8	4												38
117	**Shoal Creek @ Shoal Edge Court**	**11/18/94**								2			6	14				6									2
122	**Shoal Creek Above 1st St.**	**11/18/94**				4					20			14	24						2		4		3.5	10	197

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	GYROSIGMA SCALPROIDES	HANTZSCHIA AMPHIOXYS	MASTOGLOIA SMITHII	MELOSIRA LINEATA	NAVICULA ABSOLUTA	NAVICULA ACCOMODA	NAVICULA ANGUSTA	NAVICULA ARVENSIS	NAVICULA ATOMUS	NAVICULA BACILLOIDES	NAVICULA CINCTA	NAVICULA CRYPTOCEPHALA	NAVICULA CRYPTOTENELLA	NAVICULA DECUSSIS	NAVICULA ELGINENSIS	NAVICULA ERIFUGA	NAVICULA GOEPPERTIANA	NAVICULA HALOPHILA	NAVICULA INGENUA	NAVICULA KRIEGERII	NAVICULA LANCEOLATA	NAVICULA LONGICEPHALA	NAVICULA MENISCULUS	NAVICULA MINIMA	NAVICULA MINUSCULA
78	**Barton @ 71 Above Little Barton**	**06/29/95**			12																				6		
88	**Barton Creek @ Lost Creek Bridge**	**06/29/95**					8								8												2
53	**Barton Above Barton Springs Pool**	**06/29/95**						4							8										2		
121	**East Bouldin Creek @ Alpine Rd**	**06/27/95**					2							2				40								4	2
119	**East Bouldin @ Elizabeth St**	**06/27/95**									14			4													4
115	**East Bouldin @ Riverside**	**06/27/95**												4				2			114						12
120	**East Bouldin @ S. Austin Center**	**06/27/95**																								94	12
124	**Fort Branch Creek @ MLK**	**06/27/95**										2			2												
123	**Fort Branch @ Boggy Creek**	**06/29/95**													18	8											
126	**Fort Branch @ Glencrest Dr**	**06/29/95**					40								16				2		46						
125	**Fort Branch Above Manor Rd**	**06/29/95**												2	10												8
116	**Shoal Creek @ 24th St. (EII)**	**06/26/95**			2									2													
118	**Shoal Creek @ Crosscreek Dr**	**06/26/95**												2										2		6	
117	**Shoal Creek @ Shoal Edge Ct**	**06/26/95**					2						4	2											2		
122	**Shoal Creek Above 1st St.**	**06/26/95**					2						4	6												26	
490	**Williamson Creek @ Hwy 71**	**06/28/95**							12			4			8										2		2
344	**Williamson Creek @ Joe Tanner**	**06/28/95**					2							2	6		2								4		
300	**Williamson Creek @ Mowinkle**	**06/28/95**																									
492	**Williamson @ Pleasant Valley**	**06/30/95**					4					2			2												
491	**Williamson Creek @ IH35**	**07/07/95**												2							4						22
223	**Williamson @ McKinney Falls**	**07/07/95**					2								8								2				2

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	NAVICULA MONOCULATA	NAVICULA PSEUDANGLICA	NAVICULA PUPULA	NAVICULA PYGMAEA	NAVICULA RADIOSA	NAVICULA REICHARDTIANA	NAVICULA SCHROETERII	NAVICULA SP. 3	NAVICULA SP. 4	NAVICULA SP. 5	NAVICULA SP.1	NAVICULA SP.2	NAVICULA STROEMII	NAVICULA SUBMINISCULA	NAVICULA SUBTILISSIMA	NAVICULA TEXANA	NAVICULA TRIDENTULA	NAVICULA VENETA	NAVICULA VIRIDULA	NEIDIUM AMPLIATUM	NITZSCHIA ACICULARIS	NITZSCHIA AGNITA	NITZSCHIA AMPHIBIA	NITZSCHIA AMPHIBIOIDES	NITZSCHIA CLAUSII
78	**Barton @ 71 Above Little Barton**	**11/28/94**					8			2			2	4					2								
88	**Barton Creek @ Lost Creek Bridge**	**11/28/94**					8			6			6												2		
53	**Barton Above Barton Springs Pool**	**11/28/94**									10		4												91		
121	**East Bouldin @ Alpine Rd**	**11/21/94**							10																2		126
119	**East Bouldin @ Elizabeth St**	**11/21/94**	4													4				4	2	2			142		10
115	**East Bouldin @ Riverside Dr**	**11/21/94**			28										14	2	2	8			2			4	94		
120	**East Bouldin @ S. Austin Center**	**11/21/94**			4							14									26		2	14	151	2	
123	**Fort Branch @ Boggy Creek**	**11/18/94**																			14		4	2	66		
126	**Fort Branch @ Glencrest Dr**	**11/18/94**	56	2				4								6					54				62		4
124	**Fort Branch Creek @ MLK**	**11/18/94**	30													10									44		41
125	**Fort Branch Above Manor Rd**	**11/18/94**	6						14							4					47				32		105
116	**Shoal Creek @ 24th St. (EII)**	**11/18/94**	36						10							6					2						46
118	**Shoal Creek @ Crosscreek Drive**	**11/18/94**	14		2				4							12					2				50		6
117	**Shoal Creek @ Shoal Edge Court**	**11/18/94**	4		2														6					2			15
122	**Shoal Creek Above 1st St.**	**11/18/94**			4	2	2										2				4		4		30		

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	NAVICULA MONOCULATA	NAVICULA PSEUDANGLICA	NAVICULA PUPULA	NAVICULA PYGMAEA	NAVICULA RADIOSA	NAVICULA REICHARDTIANA	NAVICULA SCHROETERII	NAVICULA SP. 3	NAVICULA SP. 4	NAVICULA SP. 5	NAVICULA SP.1	NAVICULA SP.2	NAVICULA STROEMII	NAVICULA SUBMINISCULA	NAVICULA SUBTILISSIMA	NAVICULA TEXANA	NAVICULA TRIDENTULA	NAVICULA VENETA	NAVICULA VIRIDULA	NEIDIUM AMPLIATUM	NITZSCHIA ACICULARIS	NITZSCHIA AGNITA	NITZSCHIA AMPHIBIA	NITZSCHIA AMPHIBIOIDES	NITZSCHIA CLAUSII
78	Barton @ 71 Above Little Barton	06/29/95	6																								
88	Barton Creek @ Lost Creek Bridge	06/29/95					2								2												
53	Barton Above Barton Springs Pool	06/29/95													2										4	12	
121	East Bouldin Creek @ Alpine Rd	06/27/95	6																	6							
119	East Bouldin @ Elizabeth St	06/27/95	2																							22	8
115	East Bouldin @ Riverside	06/27/95	4													2											6
120	East Bouldin @ S. Austin Center	06/27/95	4													6										6	12
124	Fort Branch Creek @ MLK	06/27/95			4																				56		6
123	Fort Branch @ Boggy Creek	06/29/95			2											20					2				2		2
126	Fort Branch @ Glencrest Dr	06/29/95	30		4											2					2						8
125	Fort Branch Above Manor Rd	06/29/95																			2					2	20
116	Shoal Creek @ 24th St. (EII)	06/26/95																							6	14	
118	Shoal Creek @ Crosscreek Dr	06/26/95																								10	
117	Shoal Creek @ Shoal Edge Ct	06/26/95																							14		
122	Shoal Creek Above 1st St.	06/26/95	10		2				10							8				2	4				2	20	2
490	Williamson Creek @ Hwy 71	06/28/95			4				4							4				2	10				2		50
344	Williamson Creek @ Joe Tanner	06/28/95																									
300	Williamson Creek @ Mowinkle	06/28/95																			2						
492	Williamson @ Pleasant Valley	06/30/95														2									2	16	
491	Williamson Creek @ IH35	07/07/95	8																							2	
223	Williamson @ McKinney Falls	07/07/95	4													8										2	

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	NITZSCHIA CONSTRICTA	NITZSCHIA DISSIPATA	NITZSCHIA FILIFORMIS	NITZSCHIA FONTICOLA	NITZSCHIA FRUSTULUM	NITZSCHIA GRACILIFORMIS	NITZSCHIA INCONSPICUA	NITZSCHIA LIBERTRUTHII	NITZSCHIA LINEARIS	NITZSCHIA MICROCEPHALA	NITZSCHIA NANA	NITZSCHIA PALEA	NITZSCHIA PALEACEA	NITZSCHIA PELLUCIDA	NITZSCHIA PUMILA	NITZSCHIA SCALPELLIFORMIS	NITZSCHIA SP. 2	PINNULARIA GIBBA	PINNULARIA STOMATOPHORA	REIMERIA SINUATA	STAURONEIS SP.1	STEPHANODISCUS PARVUS	SURIRELLA ANGUSTA	SURIRELLA PATTELLA
78	Barton @ 71 Above Little Barton	11/28/94												14			4		4		2		2			
88	Barton Creek @ Lost Creek Bridge	11/28/94										2		2	2		2									
53	Barton Above Barton Springs Pool	11/28/94												20												
121	East Bouldin @ Alpine Rd	11/21/94	4	4							106		8	132											78	
119	East Bouldin @ Elizabeth St	11/21/94	2								13			99										4	4	
115	East Bouldin @ Riverside Dr	11/21/94	6								26		20	58				2						4	4	
120	East Bouldin @ S. Austin Center	11/21/94	2							4	28		18	62										2	25	
123	Fort Branch @ Boggy Creek	11/18/94	4	6							33		4	257											5	
126	Fort Branch @ Glencrest Dr	11/18/94		6							4		41	107						2					4	
124	Fort Branch Creek @ MLK	11/18/94										10		273										2	2	
125	Fort Branch Above Manor Rd	11/18/94			2						2		4	70		4								2	18	
116	Shoal Creek @ 24th St. (EII)	11/18/94	2		6		40				7	8		74										24	14	4
118	Shoal Creek @ Crosscreek Drive	11/18/94					2	2				34	4	223												
117	Shoal Creek @ Shoal Edge Court	11/18/94	4				206		110		2	2		20										6	4	
122	Shoal Creek Above 1st St.	11/18/94											8	102												

Appendix D - 1994,1995 EII Diatom Data

Site #	Sample Site Name	Date	NITZSCHIA CONSTRICTA	NITZSCHIA DISSIPATA	NITZSCHIA FILIFORMIS	NITZSCHIA FONTICOLA	NITZSCHIA FRUSTULUM	NITZSCHIA GRACILIFORMIS	NITZSCHIA INCONSPICUA	NITZSCHIA LIBERTRUTHII	NITZSCHIA LINEARIS	NITZSCHIA MICROCEPHALA	NITZSCHIA NANA	NITZSCHIA PALEA	NITZSCHIA PALEACEA	NITZSCHIA PELLUCIDA	NITZSCHIA PUMILA	NITZSCHIA SCALPELLIFORMIS	NITZSCHIA SP. 2	PINNULARIA GIBBA	PINNULARIA STOMATOPHORA	REIMERIA SINUATA	STAURONEIS SP.1	STEPHANODISCUS PARVUS	SURIRELLA ANGUSTA	SURIRELLA PATTELLA
78	**Barton @ 71 Above Little Barton**	**06/29/95**					8							2												
88	**Barton Creek @ Lost Creek Bridge**	**06/29/95**					10							28												
53	**Barton Above Barton Springs Pool**	**06/29/95**					2				1			6												
121	**East Bouldin Creek @ Alpine Rd**	**06/27/95**	4				40						106	234											2	
119	**East Bouldin @ Elizabeth St**	**06/27/95**					76		20					8												
115	**East Bouldin @ Riverside**	**06/27/95**	2				56		10					4												
120	**East Bouldin @ S. Austin Center**	**06/27/95**					86		8		4			4												
124	**Fort Branch Creek @ MLK**	**06/27/95**					42					84		72						4						
123	**Fort Branch @ Boggy Creek**	**06/29/95**					60					204														
126	**Fort Branch @ Glencrest Dr**	**06/29/95**	6		12		10					2		64												
125	**Fort Branch Above Manor Rd**	**06/29/95**		8	8		180					10		92												
116	**Shoal Creek @ 24th St. (EII)**	**06/26/95**					18		6			10		42												
118	**Shoal Creek @ Crosscreek Dr**	**06/26/95**		2			104							18			2									
117	**Shoal Creek @ Shoal Edge Ct**	**06/26/95**					48					10		2												
122	**Shoal Creek Above 1st St.**	**06/26/95**				4	140				2	12		30											2	
490	**Williamson Creek @ Hwy 71**	**06/28/95**		36	58		40		20		2			44								6				
344	**Williamson Creek @ Joe Tanner**	**06/28/95**					70		16			40		14												
300	**Williamson Creek @ Mowinkle**	**06/28/95**					100		24					6												
492	**Williamson @ Pleasant Valley**	**06/30/95**	2				80		58			44		8								2				
491	**Williamson Creek @ IH35**	**07/07/95**					232		10					2								4				
223	**Williamson @ McKinney Falls**	**07/07/95**		2	4		148		12			90		8												

Appendix E - 1996 EII Overall Scores and Ranking*

Site #	Sample Site Name		Water Quality	Aquatic Life	Contact Rec	Non Contact Rec	Physical Integrity	Sediment	Overall	STATE 83 X	STATE 83 Y
53	Barton Above Barton Creek Pool	‡	72	76	81	92	78	**53**	75.3	3104688.50	10068908.00
78	Barton @ Hwy 71 Above Little Barton		89	77	99	92	74	**97**	88.0	3056007.00	10079163.00
48	Barton Creek @ Hwy 71 Below Little Barton		88	68	99	73	86	85	83.2	3056142.30	10079582.00
88	Barton Creek @ Lost Creek Bridge		78	74	94	86	89	85	84.3	3083022.30	10072218.00
82	Barton Creek Below Barton Creek Blvd		67	73	96	83	80	85	80.7	3079812.80	10079360.00
879	**Barton Creek Between Dams Above Pool**	†						**85**		3105054.50	10068923.00
362	Blunn Creek - Preserve at Little Bridge		56	49	43	81	80	61	61.7	3113011.00	10058102.00
180	**Blunn Creek @ Riverside Drive**	‡	56	38	50	63	46	**61**	52.3	3115046.30	10064878.00
363	Blunn Creek @ Willow Run		53	30	100	78	66	61	64.7	3111143.30	10054984.00
364	Blunn Creek Above Stacy Pool		51	42	100	76	66	61	66.0	3113412.00	10061168.00
350	Bull Creek @ Loop 360 First Crossing		74	73	97	81	61	90	79.3	3100280.30	10108586.00
920	Bull Creek @ St. Ed's Park above dam		70	77	75	93	82	90	81.2	3097156.30	10120169.00
151	Bull Creek @ Tributary 6		62	71	87	80	91	90	80.2	3090321.50	10127393.00
347	Bull Creek Above West Bull Creek	‡	74	73	97	90	79	90	83.8	3099213.50	10103886.00
137	**Bull Creek Below West Bull Creek (TB)**	†						**90**		3099258.00	10103514.00
783	Buttermilk Creek @ Cameron Road		66	42	73	58	64	60	60.5	3131542.00	10094256.00
852	Buttermilk Creek @ Chevy Chase Road			0		55	38	60	38.3	3126312.30	10097528.00
851	**Buttermilk Creek @ Little Walnut Creek**	‡	64	54	24	62	67	**60**	55.2	3133653.30	10092353.00
782	Buttermilk Creek @ Providence Ave		67	38	34	58	52	60	51.5	3129020.50	10094288.00
849	Country Club Creek @ Crossing Place Dr			4		68	25	60	39.3	3123689.50	10059663.00
850	Country Club Creek @ East Oltorf St		72	37	65	75	41	60	58.3	3119626.50	10056154.00
848	**Country Club Creek Below Grove Drive**	‡		0		33	32	**60**	31.3	3129731.80	10062192.00
121	East Bouldin Creek @ Alpine Rd		62	9	22	70	68	54	47.5	3108436.30	10056348.00
119	East Bouldin Creek @ Elizabeth St		58	27	73	59	49	54	53.3	3110838.80	10063953.00
115	**East Bouldin Creek @ Riverside Dr**	‡	42	41	58	53	39	**54**	47.8	3113920.00	10065637.00
120	East Bouldin Creek @ S. Austin Center			0		17	52	54	30.8	3108980.00	10059926.00
123	**Fort Branch Creek @ Boggy Creek**	‡	64	44	17	68	34	**84**	51.8	3135281.00	10069583.00
126	Fort Branch Creek @ Glencrest Drive		32	33	0	59	66	84	45.7	3129200.80	10089534.00
898	Ft. Branch Creek @ Single Shot		55	48	42	71	36	84	56.0	3134377.00	10079299.00
125	Ft. Branch Creek Above Manor Rd		62	53	79	59	60	84	66.2	3131835.80	10084349.00
877	Harper's Branch @ Windoak		62	45	93	74	42	54	61.7	3115960.30	10059273.00
844	Harper's Branch @ Woodland		49	33	0	84	35	54	42.5	3116159.00	10060969.00
484	**Harper's Branch Creek @ Riverside Dr**	‡	42	47	72	58	24	**54**	49.5	3117055.30	10063670.00
857	Johnson Creek @ 11th Street (EII)	†	37	0	25	60	50	**49**	36.8	3106719.00	10075914.00
489	Johnson Creek @ 1st Street	‡		0		38	33	49	30.0	3105675.30	10073338.00
847	Johnson Creek @ South Tarrytown		39	41	63	79	40	49	51.8	3108530.50	10081016.00
897	Johnson Creek @ Woodmont			0		62	38	49	37.3	3107739.50	10078033.00
838	Little Walnut @ Golden Meadow Rd		57	44	11	68	61	86	54.5	3123553.80	10111994.00
839	Little Walnut Creek @ Hermitage Dr		64	63	55	65	71	86	67.3	3131622.00	10100399.00

Appendix E - 1996 EII Overall Scores and Ranking*

Site #	Sample Site Name		Water Quality	Aquatic Life	Contact Rec	Non Contact Rec	Physical Integrity	Sediment	Overall	STATE 83 X	STATE 83 Y
634	**Little Walnut Creek @ US183**	‡	71	68	76	64	34	**86**	66.5	3139286.80	10081771.00
840	Little Walnut Creek @ US290		61	64	17	80	64	86	62.0	3133637.80	10091889.00
784	North Boggy Creek @ Airport Rd.		30	45	0	65	73	86	49.8	3123560.50	10082307.00
853	North Boggy Creek @ Banton Road		52	50	33	55	41	86	52.8	3124815.80	10077899.00
493	**North Boggy Creek @ Delwau Lane**	‡	71	49	83	63	37	**86**	64.8	3137720.30	10069350.00
837	North Boggy Creek @ Nile Road		61	38	21	67	39	86	52.0	3123241.00	10070629.00
116	Shoal Creek @ 24th St. (EII)		47	55	45	68	51	58	54.0	3110706.00	10078082.00
118	Shoal Creek @ Crosscreek Drive		69	57	24	59	50	58	52.8	3115504.50	10108179.00
117	Shoal Creek @ Shoal Edge Court		67	62	93	79	60	58	69.8	3111947.30	10094202.00
880	**Shoal Creek @ West Avenue**	†						**58**		3111662.80	10070804.00
122	Shoal Creek Above 1st St.	‡	31	46	14	37	58	58	40.7	3111891.00	10070413.00
842	Tannehill @ Bartholomew Park		45	35	48	65	24	85	50.3	3130326.30	10083203.00
854	Tannehill Creek @ Boggy Creek	‡	69	33	91	51	35	85	60.7	3132724.50	10069080.00
660	**Tannehill Creek @ Givens Park**	†						**85**		3130357.30	10073192.00
841	Tannehill Creek @ Highland Mall		35	39	0	41	72	85	45.3	3124058.30	10090718.00
843	Tannehill Creek @ Lovell Drive		68	61	73	58	33	85	63.0	3131716.00	10079355.00
624	Waller Creek @ 23rd St. (USGS)		53	47	53	77	49	65	57.3	3116927.00	10077490.00
780	Waller Creek @ 51st Street		67	55	43	84	65	65	63.2	3119699.50	10088984.00
38	**Waller Creek @ Cesar Chavez**	‡	40	36	18	67	44	**65**	45.0	3115210.80	10068358.00
781	Waller Creek @ Shipe Park		61	54	30	74	66	65	58.3	3119175.00	10085069.00
659	Walnut Creek @ Lamar Blvd		60	54	93	73	65	88	72.2	3132792.80	10117619.00
465	Walnut Creek @ Loyola		55	63	79	60	33	88	63.0	3142307.50	10083936.00
503	**Walnut Creek @ Railroad Bridge**	‡	38	72	73	78	41	**88**	65.0	3141508.30	10070723.00
500	Walnut Creek @ Springdale Rd		64	77	23	86	44	88	63.7	3142953.50	10096688.00
464	Walnut Creek Below IH35		52	59	53	80	54	88	64.3	3135589.50	10115068.00
845	West Bouldin Creek @ Guerrero Park			0		45	51	54	37.5	3107668.80	10063694.00
878	West Bouldin Creek @ Jewell		77	38	87	72	47	54	62.5	3108380.00	10064821.00
486	**West Bouldin Creek @ Riverside Dr**	‡		0		55	42	**54**	37.8	3110001.50	10068050.00
846	West Bouldin Creek @ S. Austin Park			9		63	64	54	47.5	3105653.80	10060679.00
490	Williamson Creek @ Hwy 71 (EII)			0		60	64	86	52.5	3070630.00	10060865.00
491	Williamson Creek @ IH35 (EII)			0		60	45	86	47.8	3108294.00	10046752.00
344	Williamson Creek @ Joe Tanner			0		53	73	86	53.0	3078587.00	10057408.00
223	**Williamson Creek @ McKinney Falls**	‡	64	53	90	66	55	**86**	69.0	3121460.50	10042107.00
300	Williamson Creek @ Mowinkle			0		63	66	86	53.8	3062800.50	10060226.00
492	Williamson Creek @ Pleasant Valley		76	65	47	86	48	86	68.0	3113921.75	10039351.00

† = Indicates a site that was added because sediment was not present at the orginal mouth site.

‡ = Creek mouth site (lowest downstream monitoring site)

Appendix E - 1996 EII Non Contact Recreation Scores

Site #	Sample Site Name	Date	Clarity	Flow Volume	Litter	Odor	Percent Algae	Surface Appearance	Sum	Score
					Rating Range 1-20					
88	Barton Creed @ Lost Creek Bridge	11/20/96	19	17	19	19	16	13	103	86
48	Barton Creek Below Little Barton @ 71	11/21/96	17	10	19	18	8	15	87	73
82	Barton Creek @ Lief Johnson	11/20/96	16	13	18	19	16	17	99	83
180	Blunn Creek - Downstream/Mouth	11/20/96	16	14	4	10	15	16	75	63
362	Blunn Creek - Preserve at Little Bridge	11/19/96	18	13	18	18	18	12	97	81
364	Blunn Creek Above Stacy Pool	11/20/96	18	15	11	14	18	15	91	76
363	Blunn Creek at Willow Run	11/20/96	17	15	10	16	18	18	94	78
493	Boggy Creek - Downstream/Mouth	11/18/96	8	12	2	18	19	16	75	63
853	Boggy Creek at Banton Road	11/19/96	14	6	5	13	14	14	66	55
784	North Boggy Creek at Airport Rd.	11/19/96	15	8	8	16	15	16	78	65
837	Boggy Creek at Nile Rd.	11/18/96	17	11	10	12	14	16	80	67
347	Bull Creek - Above West Bull	11/18/96	19	16	18	19	18	18	108	90
350	Bull Creek - Loop 360	11/18/96	19	15	11	15	18	19	97	81
151	Bull Creek - Tributary 6 (EG)	11/19/96	16	18	19	19	10	14	96	80
920	Bull Creek @ St. Ed's Park above dam	11/19/96	19	17	18	20	18	20	112	93
783	Buttermilk at Cameron Rd.	11/19/96	16	13	3	7	15	16	70	58
852	Buttermilk Branch Creek at Chevy Chase	11/22/96		1	14	18			33	55
851	Buttermilk Creek at Creekside Drive	11/20/96	18	13	5	16	6	16	74	62
782	Buttermilk Creek at Providence Av.	11/19/96	16	10	7	13	5	18	69	58
850	Country Club @ Oltorf	11/19/96	17	13	10	16	18	16	90	75
849	Country Club @ Crossing Place	11/19/96	14	16	5	15	17	14	81	68
848	Country Club Mouth @ Grove Blvd.	11/19/96		1	5	14			20	33
115	East Bouldin Mouth @ Riverside	11/20/96	16	11	5	10	16	5	63	53
119	East Bouldin @ Elizabeth	11/20/96	16	6	6	11	17	15	71	59
120	East Bouldin @ Gillis Park	11/19/96		1	6	3			10	17
121	East Bouldin @ Alpine	11/19/96	18	8	10	18	18	12	84	70
125	Fort Branch @ Westminister	11/19/96	10	9	9	16	12	15	71	59
126	Fort Branch @ Glencrest	11/19/96	13	8	13	16	3	18	71	59
123	Fort Branch @ Boggy	11/18/96	18	7	2	18	18	18	81	68
898	Ft. Branch @ Single Shot	11/22/96	18	7	5	18	19	18	85	71
877	Harper's Branch @ Windoak	11/19/96	17	15	10	15	17	15	89	74
844	Harper's Branch @ Woodland	11/19/96	18	14	16	18	18	17	101	84
855	Harpers Branch at Fairlawn	11/19/96	17	5	15	18	18	17	90	75
484	Harper's Branch Downstream/Mouth	11/19/96	17	11	2	14	18	8	70	58
847	Johnson @ South Tarrytown	11/20/96	18	11	16	17	17	16	95	79

Appendix E - 1996 EII Non Contact Recreation Scores

Site #	Sample Site Name	Date	Clarity	Flow Volume	Litter	Odor	Percent Algae	Surface Appearance	Sum	Score
					Rating Range 1-20					
897	**Johnson @ Woodmont**	**11/22/96**		3	18	16			37	62
489	**Johnson Creek Mouth @ Mopac**	**11/20/96**		1	3	19			23	38
857	**Johnson Creek at 11th Street (EII)**	**11/20/96**		1	19	16			36	60
838	**Little Walnut @ Golden Meadow Rd.**	**11/20/96**	16	16	13	18	3	16	82	68
839	**Little Walnut @ Hermitage Drive**	**11/20/96**	16	15	7	9	18	13	78	65
634	**Little Walnut @ US 183**	**11/21/96**	9	15	5	13	19	16	77	64
840	**Little Walnut @ US290**	**11/21/96**	19	18	4	18	19	18	96	80
236	**Onion Creeek@ Twin Creek Bridge**	**11/18/96**	18	15	19	14	13	14	93	78
239	**Onion Creek Above I-35**	**11/18/96**	19	17	19	18	18	14	105	88
255	**Onion Creek Below Main Pool**	**11/18/96**	13	17	11	17	8	12	78	65
220	**Onion At Old Lockhart Hwy**	**11/18/96**	19	16	5	17	10	12	79	66
883	**Onion @ FM 973**	**11/18/96**	11	15	5	11	11	17	70	58
122	**Shoal @ 1st St.**	**11/20/96**	12	14	4	8	3	3	44	37
116	**Shoal @ 24th St. (EII)**	**11/19/96**	17	9	14	18	7	17	82	68
118	**Shoal @ Crosscreek Dr.**	**11/19/96**	16	13	14	12	9	7	71	59
117	**Shoal @ Shoal Edge Court (EII)**	**11/18/96**	14	15	18	18	13	17	95	79
842	**Tannehill at Bartholomew Park**	**11/19/96**	12	6	10	16	16	18	78	65
841	**Tannehill at Highland Mall**	**11/19/96**	12	6	8	13	2	8	49	41
843	**Tannehill at Lovell Drive**	**11/19/96**	7	10	4	16	18	14	69	58
854	**Tannehill Branch at Jain Lane**	**11/18/96**	1	8	3	13	18	18	61	51
624	**Waller @ 23rd St. (USGS)**	**11/19/96**	11	13	18	18	16	16	92	77
38	**Waller @ Ceasar Chavez**	**11/18/96**	10	13	7	18	14	18	80	67
780	**Waller Creek at 51st**	**11/18/96**	18	14	14	18	19	18	101	84
781	**Waller Creek at Shipe Park**	**11/18/96**	13	13	14	18	17	14	89	74
465	**Walnut at Loyola and Crystal Brook**	**11/21/96**	6	14	5	13	18	16	72	60
464	**Walnut Below I-35**	**11/20/96**	17	16	11	18	16	18	96	80
500	**Walnut Creek - at Springdale**	**11/21/96**	16	16	17	18	18	18	103	86
503	**Walnut Creek - Mouth Railroad Bridge**	**11/21/96**	13	18	9	18	18	18	94	78
659	**Walnut Creek at Lamar Blvd.**	**11/20/96**	19	17	15	13	5	19	88	73
486	**West Bouldin Mouth @ Dawson**	**11/20/96**		1	14	18			33	55
878	**West Bouldin @ Jewell**	**11/20/96**	18	6	9	18	18	17	86	72
845	**West Bouldin at Guerrero Park**	**11/19/96**		1	8	18			27	45
846	**West Bouldin at South Austin Park**	**11/19/96**	13	5	5	18	18	17	76	63
223	**Williamson Creek @ McKinney Falls**	**11/22/96**	18	16	14	18	3	10	79	66
300	**Williamson @ Mowinkle**	**11/21/96**		1	17	20			38	63

Appendix E - 1996 EII Non Contact Recreation Scores

Site #	Sample Site Name	Date	Clarity	Flow Volume	Litter	Odor	Percent Algae	Surface Appearance	Sum	Score
					Rating Range 1-20					
492	**Williamson @ Pleasant Valley**	**11/21/96**	18	16	16	19	16	18	103	86
491	**Williamson @ IH 35**	**11/22/96**		4	14	18			36	60
344	**Williamson @ Joe Tanner**	**11/21/96**		1	13	18			32	53
490	**Williamson @ Hwy 71**	**11/21/96**		1	15	20			36	60

Blank Cell indicate parameters that were not scored because there was no flowing water at the site.

Appendix E - 1996 EII Habitat Quality Scores

Site #	Sample SiteName	Date	Bank Vegetation Protection	Channel Alteration	Channel Flow Status	Condition of Banks	Disruptive Pressure	Embeddedness	Riparian Vegetative Width	Sediment Deposition	Average
			Rating 1-20 (Poor to Optimal)								
78	Barton Creek @ Hwy 71 Above Little Barton (BC0)	1/31/97	19	18	15	18	17	18	19	15	17
88	Barton Creek @ Lost Creek Bridge (BC10)	2/3/97	18	18	18	18	14	17	12	17	17
82	Barton Creek Below Barton Creek Blvd (BC4)	2/13/97	13	18	17	16	11	17	1	16	14
362	Blunn Creek - Preserve at Little Bridge	2/18/97	18	17	16	16	18	16	19	16	17
362	Blunn Creek - Preserve at Little Bridge	3/24/97	18	18	13	18	18	17	18	15	17
180	Blunn Creek @ Riverside Drive	3/3/97	12	15	14	5	17	13	8	7	11
363	Blunn Creek @ Willow Run	2/18/97	12	15	14	13	14	11	8	12	12
364	Blunn Creek Above Stacy Pool	2/18/97	15	15	13	15	12	13	6	13	13
853	Boggy Creek @ Banton Road	2/23/97	10	11	10	6	16	11	2	11	10
837	Boggy Creek @ Nile Road	2/23/97	5	6	13	4	10	8	10	7	8
784	North Boggy Creek @ Airport Rd.	2/23/97	15	15	16	15	11	16	10	15	14
493	North Boggy Creek @ Delwau Lane	2/4/97	6	10	5	7	16	9	15	6	9
493	North Boggy Creek @ Delwau Lane	3/24/97	8	14	8	10	17	7	12	7	10
350	Bull Creek @ Loop 360 First Crossing	2/5/97	13	10	10	14	13	11	8	9	11
920	Bull Creek @ St. Ed's Park above dam	2/5/97	19	20	16	18	19	14	19	15	18
347	Bull Creek Above West Bull Creek	2/21/97	15	15	18	17	16	15	12	16	16
151	Tributary 6 @ Bull Creek (EG)	2/5/97	17	17	19	19	19	19	19	19	19
783	Buttermilk Creek @ Cameron Road	3/2/97	10	18	12	10	18	11	5	16	13
852	Buttermilk Creek @ Chevy Chase Road	3/3/97	4	6	13	15	1	11	1	3	7
851	Buttermilk Creek @ Little Walnut Creek	2/4/97	11	14	11	10	8	19	4	18	12
782	Buttermilk Creek @ Providence Ave	3/3/97	4	11	13	15	1	10	1	10	8
849	Country Club Creek @ Crossing Place Drive	3/3/97	8	2	2	14	6	1	1	1	4
850	Country Club Creek @ East Oltorf St	3/3/97	13	2	7	15	10	10	9	2	9
850	Country Club Creek @ East Oltorf St	3/24/97	9	2	8	16	10	9	6	5	8
848	Country Club Creek Below Grove Drive	3/3/97	8	13	6	13	15	3	10	2	9
121	East Bouldin Creek @ Alpine Rd	2/11/97	13	14	16	15	10	16	2	16	13
119	East Bouldin Creek @ Elizabeth St	2/11/97	11	12	16	11	18	12	3	8	11
115	East Bouldin Creek @ Riverside Dr	2/5/97	8	15	8	8	14	13	4	8	10

Appendix E - 1996 EII Habitat Quality Scores

Site #	Sample SiteName	Date	Bank Vegetation Protection	Channel Alteration	Channel Flow Status	Condition of Banks	Disruptive Pressure	Embeddedness	Riparian Vegetative Width	Sediment Deposition	Average
						Rating 1-20 (Poor to Optimal)					
120	East Bouldin Creek @ South Austin Center	2/11/97	9	11	13	13	17	13	2	13	11
123	Fort Branch Creek @ Boggy Creek	2/7/97	11	7	6	6	16	7	15	6	9
126	Fort Branch Creek @ Glencrest Drive	3/1/97	10	14	17	11	10	16	5	15	12
126	Fort Branch Creek @ Glencrest Drive	3/24/97	10	14	14	10	7	11	6	13	11
125	Fort Branch Creek Above Manor Rd	3/1/97	11	15	16	11	10	14	5	16	12
898	Ft. Branch @ Single Shot	2/23/97	10	15	10	6	17	6	15	2	10
877	Harper's Branch @ Windoak	3/3/97	10	8	10	6	7	8	2	8	7
844	Harper's Branch @ Woodland	3/3/97	4	12	10	4	7	8	3	10	7
844	Harper's Branch @ Woodland	3/24/97	5	12	12	8	3	13	3	11	8
855	Harpers Branch Creek @ Fairlawn	3/3/97	4	13	10	13	6	15	2	17	10
484	Harper's Branch Creek @ Riverside Dr	3/3/97	8	10	8	4	8	6	4	3	6
847	Johnson @ South Tarrytown	2/28/97	8	13	13	9	7	13	2	6	9
897	Johnson @ Woodmont	2/13/97	8	7	18	5	8	11	5	6	9
489	Johnson Creek @ 1st Street	2/28/97	10	15	3	5	10	6	8	5	8
838	Little Walnut Creek @ Golden Meadow Rd	2/21/97	5	12	12	11	13	18	5	7	10
839	Little Walnut Creek @ Hermitage Drive	2/21/97	8	15	17	10	14	19	11	19	14
634	Little Walnut Creek @ US183	2/4/97	5	12	10	2	15	10	15	6	9
840	Little Walnut Creek @ US290	2/4/97	12	16	15	17	17	14	18	14	15
840	Little Walnut Creek @ US290	3/24/97	12	17	18	17	18	13	14	10	15
883	Onion Creek @ FM 973	3/24/97	18	18	10	8	18	8	18	5	13
255	Onion Creek @ McKinney Falls Below Pool	2/10/97	12	15	18	17	17	14	18	14	16
220	Onion Creek @ Old Lockhart Hwy (ON4)	2/10/97	17	14	16	15	13	14	15	12	15
236	Onion Creek @ Twin Creek Bridge (OC1)	2/10/97	14	18	16	17	18	17	15	16	16
239	Onion Creek Above IH35 (OC2)	2/10/97	18	17	14	18	17	14	18	17	17
116	Shoal Creek @ 24th St. (EII)	1/30/97	8	14	8	8	10	18	6	11	10
118	Shoal Creek @ Crosscreek Drive	2/21/97	8	12	14	16	8	10	4	5	10
122	Shoal Creek Above 1st St.	2/27/97	12	9	11	16	18	14	4	7	11
842	Tannehill Creek @ Bartholomew Park	1/31/97	4	6	7	4	5	3	3	3	4

Appendix E - 1996 EII Habitat Quality Scores

Site #	Sample SiteName	Date	Bank Vegetation Protection	Channel Alteration	Channel Flow Status	Condition of Banks	Disruptive Pressure	Embeddedness	Riparian Vegetative Width	Sediment Deposition	Average
			Rating 1-20 (Poor to Optimal)								
854	Tannehill Creek @ Boggy Creek	2/4/97	13	15	6	11	14	1	11	3	9
841	Tannehill Creek @ Highland Mall	3/1/97	15	13	16	16	10	16	6	15	13
843	Tannehill Creek @ Lovell Drive	2/23/97	8	6	11	5	13	4	11	2	8
38	Waller Creek @ Ceasar Chavez	2/27/97	12	11	13	7	17	11	4	4	10
624	Waller Creek @ 23rd St. (USGS)	3/2/97	8	16	12	13	1	12	1	8	9
780	Waller Creek @ 51st Street	2/3/97	10	17	14	13	4	18	4	18	12
781	Waller Creek @ Shipe Park	2/3/97	8	15	8	14	8	18	7	18	12
659	Walnut Creek @ Lamar Blvd	1/31/97	11	8	15	15	16	14	13	15	13
465	Walnut Creek @ Loyola	2/3/97	6	14	15	3	15	7	15	4	10
503	Walnut Creek @ Railroad Bridge	2/3/97	13	11	18	8	10	8	10	4	10
500	Walnut Creek @ Springdale Rd	1/31/97	5	12	15	12	11	10	11	8	11
464	Walnut Creek Below IH35	1/31/97	8	5	14	8	14	15	10	12	11
845	West Bouldin Creek @ Guerrero Park	3/3/97	9	13	8	8	15	16	3	13	11
878	West Bouldin Creek @ Jewell	2/11/97	8	11	6	8	15	15	3	12	10
486	West Bouldin Creek @ Riverside Drive	2/11/97	8	1	1	6	14	15	5	10	8
846	West Bouldin Creek @ South Austin Park	2/11/97	11	14	16	13	18	15	3	13	13
490	Williamson Creek @ Hwy 71 (EII)	2/28/97	20	15	11	16	20	8	14	5	14
491	Williamson Creek @ IH35 (EII)	2/10/97	8	14	13	12	9	6	10	8	10
344	Williamson Creek @ Joe Tanner (EII)	2/28/97	12	16	6	18	5	16	2	14	11
344	Williamson Creek @ Joe Tanner (EII)	3/28/97	13	12	14	18	8	17	3	16	13
223	Williamson Creek @ McKinney Falls (Will1)	2/10/97	13	18	17	11	13	8	9	8	12
300	Williamson Creek @ Mowinkle (MOW)	2/28/97	13	18	17	13	10	17	4	15	13
492	Williamson Creek @ Nuckols Crossing (EII)	2/10/97	8	14	15	8	3	14	10	11	10

Appendix E -1996 EII Sediment Data

Site #	Sample Site Name	Date	4_4'-DDD	4_4'-DDE	4_4'-DDT	ALPHA-CHLORDANE	GAMMA-CHLORDANE	PCB	ARSENIC	CADMIUM	COPPER	LEAD	MERCURY	ZINC	ACENAPH-THENE	PYRENE	PHENANTHR	ENE NAPH-THALENE
			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	ug/kg	ug/kg	ug/kg	ug/kg
879	Barton Creek Between Dams Above Pool	07/09/96	<54	<54	<54	<27	<27	<270	<3.5	1.01	10.05	14.99	<0.08	65.4	<3478.9	<3478.9	<3478.9	<3478.9
882	Bear Creek @ Lowden	08/19/96	<5.3	<5.3	<5.3			<100	<100	<2	15.7	<34	<0.4	73.2	<2100	<2100	<2100	<2100
180	Blunn Creek @ Riverside Drive	07/10/96	<22.5	<22.5	<22.5	<11.2	<11.2	<112	3.52	2.13	12.73	31.73	<0.08	75.58	<1198	2060.5	<1198	<1198
137	Bull Creek Below West Bull Creek (TB)	07/09/96	<35.9	<35.9	<35.9	<18	<18	<180	<3.5	0.72	7.82	6.94	<0.08	37.34	<2738.9	<2738.9	<2738.9	<2738.9
851	Buttermilk Creek @ Little Walnut Creek	09/05/96	<4.4	18	10			<44	4.4	0.27	3.4	12.3	<0.0002	30.8	<440	1600	910	<440
884	Carson @ Pringle	09/05/96	<4	<4	<4			<40	1.8	<0.3	6.1	23.3	<0.0002	35.7	<2000	<2000	<2000	<2000
848	Country Club Creek Below Grove Drive	09/05/96	3	17	22			43	2.5	<0.3	9.3	20.7	<0.0002	44.1	<430	1000	<430	<430
885	Decker Creek @ FM 969	09/05/96	<4.2	<4.2	<4.2			<42	3.4	<0.3	4	7	<0.0002	17.4	<420	<420	<420	<420
115	East Bouldin Creek @ Riverside Dr	07/09/96	<14.3	25.3	26.2	<7.16	<7.16	<71.6	4.75	0.82	7.33	34.1	<0.08	47.03	<981.8	<981.8	<981.8	<981.8
887	Elm Creek @ Milo Rd	09/05/96	<5.1	<5.1	<5.1			<51	3.5	<0.35	10.4	10.5	<0.0002	38.7	<510	<510	<510	<510
123	Fort Branch Creek @ Boggy Creek	09/05/96	<3.9	3.9	6.8			<39	1.8	<0.3	<3	4.7	<0.0002	14.8	<390	<390	<390	<390
886	Gilleland Creek @ FM 969	09/05/96	<4.1	<4.1	<4.1			<41	4.2	<0.3	<3.5	4.1	<0.0002	12.9	<410	<410	<410	<410
484	Harper's Branch Creek @ Riverside Dr	07/10/96	<16.3	<16.3	38			<81.5	<3.33	1.87	9.99	44.52	<0.08	67.07	<859.6	3795.6	1961.4	<859.6
888	Harris Branch @ Cameron	09/05/96	<4.8	<4.8	<4.8			<48	8.9	0.3	7.1	10.2	<0.0002	33.3	<480	<480	<480	<480
857	Johnson Creek @ 11th Street (EII)	07/09/96	<17.7	100	120	<8.85	<8.85	<88.5	5.78	1.41	12.06	53.62	<0.08	83.7	<1149.4	<1149.4	<1149.4	<1149.4
634	Little Walnut Creek @ US183	07/10/96	<20.5	<20.5	<20.5	<10.2	<10.2	<102	6.3	1.53	6.08	3.86	<0.08	37.92	<1053.8	<1053.8	<1053.8	<1053.8
231	Marble Creek Above Onion Creek (M#1)	08/19/96	<5	<5	<5			<97	<200	<3.5	<17	<67	<0.3	70.1	<1900	<1900	<1900	<1900
493	North Boggy Creek @ Delwau Lane	07/10/96	<20.9	<20.9	<20.9	<10.4	<10.4	<104.9	4.84	1.13	7.83	10.4	<0.08	42.57	<1114.4	<1114.4	<1114.4	<1114.4
883	Onion Creek @ FM 973	08/19/96	<2.9	<2.9	<2.9			<55	<400	<7	<34	<140	<0.3	124	<1100	<1100	<1100	<1100
233	Rinard Creek @ Bradshaw	08/19/96	<4.6	<4.6	<4.6			<90	<200	<3.5	<17	<67	<0.3	52.4	<1800	<1800	<1800	<1800
880	Shoal Creek @ West Avenue	07/09/96	<14.6	<14.6	<14.6	<7.32	<7.32	<73.2	10.95	1.52	7.76	43.07	<0.08	49.93	<1041.6	2916.5	1262.4	<1041.6
229	Slaughter Creek @ IH35 (S1)	08/19/96	<3.4	<3.4	<3.4			<67	<200	<3.5	<17	<67	<0.3	170	<1300	<1300	<1300	<1300
660	Tannehill Creek @ Givens Park	07/10/96	<30.6	<30.6	<30.6	<15.3	<15.3	<153	3.51	1.71	10.59	9.97	<0.08	53.27	<1588.9	<1588.9	<1588.9	<1588.9
889	Taylor Slough North Below Pecos Street	08/19/96	4.2	16	7.2			<40	<105	<2	<8.5	106	<0.2	64.2	<800	2800	1900	<800
890	Taylor Slough South Below Reed Park	08/19/96	7.4	30	12			<42	<200	<3.5	<17	<67	<0.2	81.1	<840	2200	2100	<840
38	Waller Creek @ Ceasar Chavez	07/10/96	<16.9	<16.9	<16.9	<8.44	<8.44	<84.4	1.99	<0.66	7.59	25.4	<0.08	29.9	<827.2	2494.7	1361.5	<827.2
503	Walnut Creek @ Railroad Bridge	07/10/96	<20.2	<20.2	<20.2	<10.1	<10.1	<101	4.08	1.08	5.13	5.6	<0.08	33.84	<1010.8	<1010.8	<1010.8	<1010.8
463	Wells Branch Creek @ Walnut Metro Park	09/05/96	<4.6	<4.6	<4.6			<46	6.4	0.43	3.5	5.3	<0.0002	23.6	<460	<460	<460	<460
878	West Bouldin Creek @ Jewell	07/09/96	<17.5	50.8	30.6	<8.76	<8.76	<87.6	10.13	1.42	8.39	20.36	<0.08	52.35	<851.3	<851.3	<851.3	<851.3
343	West Bull Creek Above Bull Creek (EK)	08/19/96	<2.3	<2.3	<2.3			<45	<200	<3.5	<17	<67	<0.2	35.9	<900	<900	<900	<900
223	Williamson Creek @ McKinney Falls	07/09/96	<21.2	<21.2	<21.2	<10.6	<10.6	<106	6.72	1.18	5.76	5.58	<0.08	34.95	<1313.9	<1313.9	<1313.9	<1313.9

Appendix E -1996 EII Sediment Data

Site #	Sample Site Name	Date	INDENO-(1_2_3-CD)-PYRENE	FLUORENE	FLUORO-ANTHENE	DIBENZA(H)-ANTHRA-CENE	CHRYSENE	BENZO(K)-FLUOR-ANTHENE	BENZO(GHI)-PERYLENE	BENZO(A)-PYRENE	BENZO(A)-ANTHRA-CENE	3_4-BENZO-FLUOR-ANTHENE	ANTHRA-CENE	ACENAPH-THYLENE	BENZO(B+K)-FLUOR-ANTHENE	BENZO(B)-FLUOR-ANTHENE
			ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
879	Barton Creek Between Dams Above Pool	07/09/96	<3478.9	<3478.9	<3478.9	<3478.9	<3478.9	<3478.9	<3478.9	<3478.9	<3478.9	<3478.9	<3478.9	<3478.9		
882	Bear Creek @ Lowden	08/19/96	<2100	<2100	<2100	<2100	<2100		<2100	<2100	<2100		<2100	<2100	<4200	
180	Blunn Creek @ Riverside Drive	07/10/96	<1198	<1198	2348	<1198	2041.3	<1198	<1198	1260.2	<1198	2010.2	<1198	<1198		
137	Bull Creek Below West Bull Creek (TB)	07/09/96	<2738.9	<2738.9	<2738.9	<2738.9	<2738.9	<2738.9	<2738.9	<2738.9	<2738.9	<2738.9	<2738.9	<2738.9		
851	Buttermilk Creek @ Little Walnut Creek	09/05/96	570	<440	1800	<440	1200	960	540	980	790		<440	<440		1100
884	Carson @ Pringle	09/05/96	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000	<2000		<2000	<2000		<2000
848	Country Club Creek Below Grove Drive	09/05/96	<430	<430	1000	<430	660	650	<430	620	640		<430	<430		560
885	Decker Creek @ FM 969	09/05/96	<420	<420	<420	<420	<420	<420	<420	<420	<420		<420	<420		<420
115	East Bouldin Creek @ Riverside Dr	07/09/96	<981.8	<981.8	<981.8	<981.8	<981.8	<981.8	<981.8	<981.8	<981.8	<981.8	<981.8	<981.8		
887	Elm Creek @ Milo Rd	09/05/96	<510	<510	<510	<510	<510	<510	<510	<510	<510		<510	<510		<510
123	Fort Branch Creek @ Boggy Creek	09/05/96	<390	<390	<390	<390	<390	<390	<390	<390	<390		<390	<390		<390
886	Gilleland Creek @ FM 969	09/05/96	<410	<410	<410	<410	<410	<410	<410	<410	<410		<410	<410		<410
484	Harper's Branch Creek @ Riverside Dr	07/10/96	1332.2	<859.6	4160	<859.6	2925.7	1236	1105.3	1768.8	1481.8	2724.6	<859.6	<859.6		
888	Harris Branch @ Cameron	09/05/96	<480	<480	<480	<480	<480	<480	<480	<480	<480		<480	<480		<480
857	Johnson Creek @ 11th Street (EII)	07/09/96	<1149.4	<1149.4	<1149.4	<1149.4	<1149.4	<1149.4	<1149.4	<1149.4	<1149.4	<1149.4	<1149.4	<1149.4		
634	Little Walnut Creek @ US183	07/10/96	<1053.8	<1053.8	<1053.8	<1053.8	<1053.8	<1053.8	<1053.8	<1053.8	<1053.8	<1053.8	<1053.8	<1053.8		
231	Marble Creek Above Onion Creek (M#1)	08/19/96	<1900	<1900	<1900	<1900	<1900		<1900	<1900	<1900		<1900	<1900	<3900	
493	North Boggy Creek @ Delwau Lane	07/10/96	<1114.4	<1114.4	<1114.4	<1114.4	<1114.4	<1114.4	<1114.4	<1114.4	<1114.4	<1114.4	<1114.4	<1114.4		
883	Onion Creek @ FM 973	08/19/96	<1100	<1100	<1100	<1100	<1100		<1100	<1100	<1100		<1100	<1100	<2200	
233	Rinard Creek @ Bradshaw	08/19/96	<1800	<1800	<1800	<1800	<1800		<1800	<1800	<1800		<1800	<1800	<3600	
880	Shoal Creek @ West Avenue	07/09/96	<1041.6	<1041.6	3366.4	<1041.6	2333.2	1054.1	<1041.6	1529.1	1335.3	2149.9	<1041.6	<1041.6		
229	Slaughter Creek @ IH35 (S1)	08/19/96	<1300	<1300	<1300	<1300	<1300		<1300	<1300	<1300		<1300	<1300	<2700	
660	Tannehill Creek @ Givens Park	07/10/96	<1588.9	<1588.9	<1588.9	<1588.9	<1588.9	<1588.9	<1588.9	<1588.9	<1588.9	<1588.9	<1588.9	<1588.9		
889	Taylor Slough North Below Pecos Street	08/19/96	<800	<800	3200	<800	2100		<800	1800	1500		<800	<800	4200	
890	Taylor Slough South Below Reed Park	08/19/96	<840	<840	2700	<840	1400		<840	1200	1200		<840	<840	2400	
38	Waller Creek @ Ceasar Chavez	07/10/96	<827.2	<827.2	2881.8	<827.2	1968.6	759.3	<827.2	1133.2	1136.5	1598	<827.2	<827.2		
503	Walnut Creek @ Railroad Bridge	07/10/96	<1010.8	<1010.8	<1010.8	<1010.8	<1010.8	<1010.8	<1010.8	<1010.8	<1010.8	<1010.8	<1010.8	<1010.8		
463	Wells Branch Creek @ Walnut Metro Park	09/05/96	<460	<460	<460	<460	<460	<460	<460	<460	<460		<460	<460		<460
878	West Bouldin Creek @ Jewell	07/09/96	<851.3	<851.3	<851.3	<851.3	<851.3	<851.3	<851.3	<851.3	<851.3	<851.3	<851.3	<851.3		
343	West Bull Creek Above Bull Creek (EK)	08/19/96	<900	<900	<900	<900	<900		<900	<900	<900		<900	<900	<1800	
223	Williamson Creek @ McKinney Falls	07/09/96	<1313.9	<1313.9	<1313.9	<1313.9	<1313.9	<1313.9	<1313.9	<1313.9	<1313.9	<1313.9	<1313.9	<1313.9		

Appendix E - 1996 EII Water Chemistry Data

Site #	Sample Site Name	Date	Ammonia as N mg/L	Fecal Coliform Colonies/100ml	Nitrate as N mg/L	Orthophosphorus as P mg/L	Total Dissolved Solids mg/L	Total Suspended Solids mg/L
48	**Barton Creek @ 71 Below Little Barton**	**11/12/96**	<0.01	12	<0.1	0.02	276	<0.5
88	**Barton Creek @ Lost Creek Bridge**	**11/12/96**	<0.01	91	<0.1	0.03	394	<0.5
82	**Barton Below Barton Creek Blvd**	**11/12/96**	<0.01	59	<0.1	0.03	374	4.8
362	**Blunn Creek-Preserve at Little Bridge**	**11/12/96**	<0.01	1290	0.3	0.06	362	1.2
180	**Blunn Creek @ Riverside Drive**	**11/12/96**	0.01	1000	0.1	0.11	539	1.2
363	**Blunn Creek @ Willow Run**	**11/12/96**	0.01	0	0.9	0.09	392	4.2
364	**Blunn Creek Above Stacy Pool**	**11/12/96**	0.16	0	<0.1	0.09	894	7.8
853	**Boggy Creek @ Banton Road**	**11/12/96**	0.08	1700	0.2	0.16	327	1.8
837	**Boggy Creek @ Nile Road**	**11/12/96**	0.03	3300	0.1	0.17	307	0.8
784	**North Boggy Creek @ Airport Rd.**	**11/12/96**	0.02	26200	1	0.15	484	4.2
493	**North Boggy Creek @ Delwau Lane**	**11/12/96**	0.01	265	0.1	0.05	225	3.6
350	**Bull Creek @ Loop 360 First Crossing**	**11/12/96**	<0.01	42	<0.1	0.03	664	<0.5
920	**Bull Creek @ St. Ed's Park above dam**	**11/12/96**	<0.01	402	<0.1	0.02	678	<0.5
347	**Bull Creek Above West Bull Creek**	**11/12/96**	<0.01	53	<0.1	0.03	682	<0.5
151	**Tributary 6 @ Bull Creek (EG)**	**11/12/96**	<0.01	210	<0.1	0.02	960	3.2
783	**Buttermilk Creek @ Cameron Road**	**11/12/96**	<0.01	440	0.3	0.03	365	<0.5
851	**Buttermilk @ Little Walnut Creek**	**11/12/96**	<0.01	2300	0.3	0.05	317	<0.5
782	**Buttermilk Creek @ Providence Ave**	**11/12/96**	0.02	1650	0.1	0.04	381	<0.5
850	**Country Club Creek @ East Oltorf St**	**11/11/96**	<0.01	630	<0.1	0.07	327	<0.5
121	**East Bouldin Creek @ Alpine Rd**	**11/12/96**	0.02	3000	0.3	0.05	297	<0.5
119	**East Bouldin Creek @ Elizabeth St**	**11/12/96**	0.12	440	0.2	0.09	319	0.8
115	**East Bouldin Creek @ Riverside Dr**	**11/12/96**	0.08	810	1.3	0.15	274	2.8
123	**Fort Branch Creek @ Boggy Creek**	**11/12/96**	<0.01	4470	<0.1	0.04	300	1.6
126	**Fort Branch Creek @ Glencrest Drive**	**11/12/96**	0.05	11700	0.6	0.21	328	10.8
125	**Fort Branch Creek Above Manor Rd**	**11/12/96**	0.01	330	0.1	0.03	216	17.8
898	**Ft. Branch @ Single Shot**	**11/12/96**	<0.01	1330	<0.1	0.06	621	1.8
877	**Harper's Branch @ Windoak**	**11/12/96**	0.01	106	0.8	0.13	411	<0.5
844	**Harper's Branch @ Woodland**	**11/12/96**	<0.01	20400	0.6	0.14	434	<0.5
484	**Harper's Branch Creek @ Riverside**	**11/12/96**	0.03	484	2.1	0.09	439	1.2
855	**Harpers Branch Creek @ Fairlawn**	**11/12/96**	<0.01	6000	1.8	0.07	448	1
847	**Johnson @ South Tarrytown**	**11/12/96**	0.03	700	0.5	0.23	1074	2

Appendix E - 1996 EII Water Chemistry Data

Site #	Sample Site Name	Date	Ammonia as N mg/L	Fecal Coliform Colonies/100ml	Nitrate as N mg/L	Orthophosphorus as P mg/L	Total Dissolved Solids mg/L	Total Suspended Solids mg/L
857	**Johnson Creek @ 11th Street (EII)**	**11/12/96**	0.34	2100	0.2	0.36	472	6.6
838	**Little Walnut @ Golden Meadow**	**11/12/96**	<0.01	6400	0.1	0.02	324	7.6
839	**Little Walnut Creek @ Hermitage Dr**	**11/12/96**	<0.01	870	0.4	0.01	306	0.6
634	**Little Walnut Creek @ US183**	**11/12/96**	<0.01	380	0.2	0.02	267	1.2
840	**Little Walnut Creek @ US290**	**11/12/96**	0.04	4510	0.3	0.03	282	<0.5
883	**Onion Creek @ FM 973**	**11/11/96**	0.01	52	<0.1	0.04	311	8.8
255	**Onion Creek @ McKinney Falls**	**11/10/96**	<0.01	9	0.7	0.03	336	<0.5
220	**Onion Creek @ Old Lockhart Hwy**	**11/10/96**	<0.01	15	0.2	0.03	334	<0.5
236	**Onion Creek @ Twin Creek Bridge**	**11/10/96**	<0.01	59	0.1	0.02	332	<0.5
239	**Onion Creek Above IH35 (OC2)**	**11/10/96**	<0.01	200	0.1	0.04	339	<0.5
116	**Shoal Creek @ 24th St. (EII)**	**11/12/96**	0.01	1220	0.3	0.06	789	1.77
118	**Shoal Creek @ Crosscreek Drive**	**11/12/96**	<0.01	2400	<0.1	0.01	593	<0.5
117	**Shoal Creek @ Shoal Edge Court (EII)**	**11/12/96**	<0.01	117	<0.1	0.03	402	2.6
122	**Shoal Creek Above 1st St.**	**11/12/96**	0.1	5400	1.2	0.27	836	1.6
842	**Tannehill Creek @ Bartholomew Park**	**11/12/96**	0.09	1100	0.2	0.05	285	19.4
854	**Tannehill Creek @ Boggy Creek**	**11/12/96**	0.02	142	<0.1	0.06	347	1.2
841	**Tannehill Creek @ Highland Mall**	**11/12/96**	0.07	48000	0.6	0.17	372	3
843	**Tannehill Creek @ Lovell Drive**	**11/12/96**	<0.01	453	0.1	0.05	329	1.2
38	**Waller Creek @ Ceasar Chavez**	**11/12/96**	0.04	4200	0.4	0.24	431	2.4
624	**Waller Creek @ 23rd St. (USGS)**	**11/12/96**	<0.01	940	0.8	0.18	430	<0.5
780	**Waller Creek @ 51st Street**	**11/12/96**	<0.01	1270	0.2	0.08	320	<0.5
781	**Waller Creek @ Shipe Park**	**11/12/96**	0.01	1800	0.1	0.07	437	0.8
659	**Walnut Creek @ Lamar Blvd**	**11/12/96**	<0.01	108	0.6	0.2	342	1
465	**Walnut Creek @ Loyola**	**11/12/96**	<0.01	330	0.2	0.06	293	11.6
503	**Walnut Creek @ Railroad Bridge**	**11/12/96**	0.02	460	1.8	3.1	416	3
500	**Walnut Creek @ Springdale Rd**	**11/12/96**	<0.01	2600	0.3	0.07	304	<0.5
464	**Walnut Creek Below IH35**	**11/12/96**	<0.01	940	0.7	0.19	355	0.6
878	**West Bouldin Creek @ Jewell**	**11/21/96**	<0.01	212	0.1	0.03	248	0.6
223	**Williamson Creek @ McKinney Falls**	**11/10/96**	<0.01	156	1	0.04	352	<0.5
492	**Williamson Creek @ Pleasant Valley**	**11/10/96**	<0.01	1130	0.1	0.05	252	<0.5

Appendix E - 1996 EII Benthic Macroinvertebrate Data

Site #	Sample Site Name	Date	Agabinus	Agabus	Ambrysus	Amphipoda	Anopheles	Archilestes	Argia	Atrichopogon	Baetidae	Baetis	Baetodes	Berosus	Brechmorhoga	Caenis	Caloparaphus	Camelobaetidius	Celina	Ceratopogon	Ceratopogonidae	Cernotina	Cheumatopsyche	Chimarra	Chironomidae
48	Barton Creek @ 71 Below Little Barton	11/21/96							67	1	12			16	6	27		1			121				74
88	Barton Creek @ Lost Creek Bridge	11/20/96			2				165	1	14			6	4	10	1	3				17	144	296	228
82	Barton Creek Below Barton Creek Blvd	11/20/96							113		36				17	3		8					111	537	239
362	Blunn Creek - Preserve at Little Bridge	11/19/96							20		9														6
180	Blunn Creek @ Riverside Drive	11/20/96							6		1														9
363	Blunn Creek @ Willow Run	11/19/96							4	2	1														5
364	Blunn Creek Above Stacy Pool	11/20/96							64														1		46
853	Boggy Creek @ Banton Road	11/19/96							40	4															27
784	North Boggy Creek @ Airport Rd.	11/19/96							32																16
493	North Boggy Creek @ Delwau Lane	11/18/96							1																
837	Boggy Creek @ Nile Road	11/18/96							8														4		7
350	Bull Creek @ Loop 360 First Crossing	11/18/96			1				59		36			7	22			8					24	53	28
920	Bull Creek @ St. Ed's Park above dam	11/20/96							217	1	115			3	8		11	216			2	4	158	1214	492
347	Bull Creek Above West Bull Creek	11/18/96							80		47				11	2		38				1	115	502	47
151	Tributary 6 @ Bull Creek (EG)	11/19/96							94		121			2		5	125	1					6	8	197
783	Buttermilk Creek @ Cameron Road	11/19/96							19						1								4		31
851	Buttermilk Creek @ Little Walnut	11/20/96	1						35		9				4		2	15					3	5	57
782	Buttermilk Creek @ Providence Ave	11/19/96							122																69
850	Country Club Creek @ East Oltorf St	11/19/96							3		4			1											
119	East Bouldin Creek @ Elizabeth St	11/20/96	1					5	9																7
115	East Bouldin Creek @ Riverside Dr	11/20/96							11																16
123	Fort Branch Creek @ Boggy Creek	11/18/96							1																
126	Fort Branch Creek @ Glencrest Drive	11/19/96							31												1				58
125	Fort Branch Creek Above Manor Rd	11/19/96							44		9										1				22
898	Ft. Branch @ Single Shot	11/22/96							2																1
877	Harper's Branch @ Windoak	11/19/96							43					1				1							5
844	Harper's Branch @ Woodland	11/19/96							17						1								1		2
484	Harper's Branch Creek @ Riverside	11/19/96							9		7														48
847	Johnson @ South Tarrytown	11/20/96							89		3							2					2	1	158
838	Little Walnut Creek @ Golden Meadow	11/20/96							26					1				1							47
839	Little Walnut Creek @ Hermitage	11/20/96							30									131							26
634	Little Walnut Creek @ US183	11/21/96							19		22				1			22							36
840	Little Walnut Creek @ US290	11/21/96																1					1		29
883	Onion Creek @ FM 973	11/18/96							73		1				2	37		3		1			22	4	55
255	Onion Creek @ McKinney Falls	11/18/96					1		124	1	27			23	7	33		10					120	17	210
220	Onion Creek @ Old Lockhart Hwy	11/18/96			13				58		44			8	1	2		2					111	84	69
236	Onion Creek @ Twin Creek Bridge	11/18/96	3		2				21	2	20			7	3	5							4	49	97
239	Onion Creek Above IH35 (OC2)	11/18/96			13				19		23			1		1		2					75	78	63
116	Shoal Creek @ 24th St. (EII)	11/19/96		3					70		123					1	8	3					1		224
118	Shoal Creek @ Crosscreek Drive	11/19/96			8				41	1	59			1										1	205
117	Shoal Creek @ Shoal Edge Court	11/18/96							230		43			1		1	2	14					82	1	205

Site #	Sample Site Name	Date	Choroterpes	Chrysops	Cleptelmis	Coenagrionidae	Coleoptera	Collembola	Copepoda	Corbicula	Corythrella	Corydallus	Cryphocricos	Culicidae	Decapoda	Derovatellus	Diptera	Discocerina	Dolichopodidae	Dromogomphus
48	Barton Creek @ 71 Below Little Barton	11/21/96												6						
88	Barton Creek @ Lost Creek Bridge	11/20/96						1		45				22						
82	Barton Creek Below Barton Creek Blvd	11/20/96						2				1								
362	Blunn Creek - Preserve at Little Bridge	11/19/96																		
180	Blunn Creek @ Riverside Drive	11/20/96													2					
363	Blunn Creek @ Willow Run	11/19/96													1					
364	Blunn Creek Above Stacy Pool	11/20/96																		
853	Boggy Creek @ Banton Road	11/19/96																		
784	North Boggy Creek @ Airport Rd.	11/19/96													6					
493	North Boggy Creek @ Delwau Lane	11/18/96																		
837	Boggy Creek @ Nile Road	11/18/96																		
350	Bull Creek @ Loop 360 First Crossing	11/18/96								21										
920	Bull Creek @ St. Ed's Park above dam	11/20/96								1										2
347	Bull Creek Above West Bull Creek	11/18/96								1				1						
151	Tributary 6 @ Bull Creek (EG)	11/19/96								11					1					
783	Buttermilk Creek @ Cameron Road	11/19/96																		
851	Buttermilk Creek @ Little Walnut	11/20/96																		
782	Buttermilk Creek @ Providence Ave	11/19/96													4					
850	Country Club Creek @ East Oltorf St	11/19/96																		
119	East Bouldin Creek @ Elizabeth St	11/20/96																		
115	East Bouldin Creek @ Riverside Dr	11/20/96																		
123	Fort Branch Creek @ Boggy Creek	11/18/96									1									
126	Fort Branch Creek @ Glencrest Drive	11/19/96						1												
125	Fort Branch Creek Above Manor Rd	11/19/96													1				1	
898	Ft. Branch @ Single Shot	11/22/96									1				1					
877	Harper's Branch @ Windoak	11/19/96								1										
844	Harper's Branch @ Woodland	11/19/96																		
484	Harper's Branch Creek @ Riverside	11/19/96						1	1											
847	Johnson @ South Tarrytown	11/20/96																		
838	Little Walnut Creek @ Golden Meadow	11/20/96													1					
839	Little Walnut Creek @ Hermitage	11/20/96																		
634	Little Walnut Creek @ US183	11/21/96																		
840	Little Walnut Creek @ US290	11/21/96								3										
883	Onion Creek @ FM 973	11/18/96	16							13										
255	Onion Creek @ McKinney Falls	11/18/96								13										
220	Onion Creek @ Old Lockhart Hwy	11/18/96							2	236									1	1
236	Onion Creek @ Twin Creek Bridge	11/18/96								5										1
239	Onion Creek Above IH35 (OC2)	11/18/96								15					1					
116	Shoal Creek @ 24th St. (EII)	11/19/96					1	9							3					
118	Shoal Creek @ Crosscreek Drive	11/19/96																		
117	Shoal Creek @ Shoal Edge Court	11/18/96						1		6										

Appendix E - 1996 EII Benthic Macroinvertebrate Data

Site #	Sample Site Name	Date	Agabinus	Agabus	Ambrysus	Amphipoda	Anopheles	Archilestes	Argia	Atrichopogon	Baetidae	Baetis	Baetodes	Berosus	Brechmorhoga	Caenis	Caloparaphus	Camelobaetidius	Celina	Ceratopogon	Ceratopogonidae	Cernotina	Cheumatopsyche	Chimarra	Chironomidae
122	Shoal Creek Above 1st St.	11/20/96							42		24				1						2				1001
842	Tannehill Creek @ Bartholomew Park	11/19/96							3																2
854	Tannehill Creek @ Boggy Creek	11/18/96							3								1								1
841	Tannehill Creek @ Highland Mall	11/19/96							3																505
843	Tannehill Creek @ Lovell Drive	11/19/96							11		6							6						1	61
38	Waller Creek @ Ceasar Chavez	11/18/96							2																15
624	Waller Creek @ 23rd St. (USGS)	11/19/96							23		14														51
780	Waller Creek @ 51st Street	11/18/96							65		9														223
781	Waller Creek @ Shipe Park	11/18/96							49		4														149
659	Walnut Creek @ Lamar Blvd	11/20/96							136									63					262	857	175
465	Walnut Creek @ Loyola	11/21/96							12									14					46	39	25
503	Walnut Creek @ Railroad Bridge	11/21/96							20						8			3					1	1	11
500	Walnut Creek @ Springdale Rd	11/20/96							17		147				17			45					116	482	196
464	Walnut Creek Below IH35	11/20/96							26		99		1		2								152	763	63
878	West Bouldin Creek @ Jewell	11/20/96							17																3
223	Williamson Creek @ McKinney Falls	11/22/96		1	1				10	4	18			51		22					2			1	736
492	Williamson Creek @ Nuckols Crossing	11/21/96							110	1	119			13	7	2		2			3		117	12	286
	Grand Totals		5	4	40	29	1	34	2996	18	1380	756	1	143	129	171	150	678	3	1	133	22	2642	5297	8582

Site #	Sample Site Name	Date	Choroterpes	Chrysops	Cleptelmis	Coenagrionidae	Coleoptera	Collembola	Copepoda	Corbicula	Corythrella	Corydallus	Cryphocricos	Culicidae	Decapoda	Derovatellus	Diptera	Discocerina	Dolichopodidae	Dromogomphus
122	Shoal Creek Above 1st St.	11/20/96							8											
842	Tannehill Creek @ Bartholomew Park	11/19/96													3					
854	Tannehill Creek @ Boggy Creek	11/18/96																		
841	Tannehill Creek @ Highland Mall	11/19/96													3					
843	Tannehill Creek @ Lovell Drive	11/19/96																		
38	Waller Creek @ Ceasar Chavez	11/18/96													1					
624	Waller Creek @ 23rd St. (USGS)	11/19/96																		
780	Waller Creek @ 51st Street	11/18/96						3	7											
781	Waller Creek @ Shipe Park	11/18/96							2											
659	Walnut Creek @ Lamar Blvd	11/20/96																		
465	Walnut Creek @ Loyola	11/21/96																		2
503	Walnut Creek @ Railroad Bridge	11/21/96			8															
500	Walnut Creek @ Springdale Rd	11/20/96																		
464	Walnut Creek Below IH35	11/20/96																		
878	West Bouldin Creek @ Jewell	11/20/96						1												
223	Williamson Creek @ McKinney Falls	11/22/96								27				1						
492	Williamson Creek @ Nuckols Crossing	11/21/96		1				4		5				12	2			1		
	Grand Totals		16	1	8	1	4	24	21	406	2	4	9	140	45	8	5	1	2	6

Appendix E - 1996 EII Benthic Macroinvertebrate Data

Site #	Sample Site Name	Date	Dubiraphia	Dugesia	Dytiscidae	Elmidae	Empididae	Erpetogomphus	Erpobdellidae	Eulophidae	Eupharyphus	Fallceon	Gammarus	Gastropoda	Gerris	Glossiphonidae	Gomphidae	Gomphus	Hebetancylus	Hebrus	Helichus	Helicophyche	Helochares	Hemerodromia
48	Barton Creek @ 71 Below Little Barton	11/21/96																						
88	Barton Creek @ Lost Creek Bridge	11/20/96		8					3			3						6	10			13		1
82	Barton Creek Below Barton Creek Blvd	11/20/96		31				1				8							4			13		2
362	Blunn Creek - Preserve at Little Bridge	11/19/96			1							6							1					
180	Blunn Creek @ Riverside Drive	11/20/96														3								
363	Blunn Creek @ Willow Run	11/19/96																		2				
364	Blunn Creek Above Stacy Pool	11/20/96																						4
853	Boggy Creek @ Banton Road	11/19/96		1								1							148					
784	North Boggy Creek @ Airport Rd.	11/19/96																	76					
493	North Boggy Creek @ Delwau Lane	11/18/96										1												
837	Boggy Creek @ Nile Road	11/18/96		2															12					
350	Bull Creek @ Loop 360 First Crossing	11/18/96		13							2	17										18		
920	Bull Creek @ St. Ed's Park above dam	11/20/96		2								144				1			1			1		2
347	Bull Creek Above West Bull Creek	11/18/96		5								18												5
151	Tributary 6 @ Bull Creek (EG)	11/19/96		71								67				1	3		29			40	1	
783	Buttermilk Creek @ Cameron Road	11/19/96																						
851	Buttermilk Creek @ Little Walnut	11/20/96		1					1			6												
782	Buttermilk Creek @ Providence Ave	11/19/96																2						
850	Country Club Creek @ East Oltorf St	11/19/96																						
119	East Bouldin Creek @ Elizabeth St	11/20/96		2															2					
115	East Bouldin Creek @ Riverside Dr	11/20/96		1															21					
123	Fort Branch Creek @ Boggy Creek	11/18/96										1												
126	Fort Branch Creek @ Glencrest Drive	11/19/96										2				1			5			1		1
125	Fort Branch Creek Above Manor Rd	11/19/96		1															5					
898	Ft. Branch @ Single Shot	11/22/96																						
877	Harper's Branch @ Windoak	11/19/96		1												9			4					
844	Harper's Branch @ Woodland	11/19/96														6								
484	Harper's Branch Creek @ Riverside	11/19/96		2								2							13					
847	Johnson @ South Tarrytown	11/20/96														1						1		6
838	Little Walnut Creek @ Golden Meadow	11/20/96		12							1								7					
839	Little Walnut Creek @ Hermitage	11/20/96		2								123				1			1					
634	Little Walnut Creek @ US183	11/21/96										13												
840	Little Walnut Creek @ US290	11/21/96		8															2					1
883	Onion Creek @ FM 973	11/18/96		8				2								1			128		4	3		
255	Onion Creek @ McKinney Falls	11/18/96		9					4							3			9			36		
220	Onion Creek @ Old Lockhart Hwy	11/18/96		25					26			2							145		2	36		
236	Onion Creek @ Twin Creek Bridge	11/18/96																	92			2		
239	Onion Creek Above IH35 (OC2)	11/18/96		53				1				44	19									4		
116	Shoal Creek @ 24th St. (EII)	11/19/96		4					2		1					164			5					
118	Shoal Creek @ Crosscreek Drive	11/19/96		165															2					
117	Shoal Creek @ Shoal Edge Court	11/18/96		5					12			33				15			256			2		2

Site #	Sample Site Name	Heptageniidae	Hetaerina	Heterelmis	Hexacylloepus	Hexatoma	Hirudinea	Holorusia	Hyallela	Hydaticus	Hydracarina	Hydrochus	Hydrophilidae	Hydoptila	Laccophilus	Lepidoptera	Leptohypes	Leptophlebidae	Leucotrichia	Libellula	Libellulidae	Limnoporous	Limonia
48	Barton Creek @ 71 Below Little Barton										9												
88	Barton Creek @ Lost Creek Bridge		3		22						11			18									
82	Barton Creek Below Barton Creek Blvd			2	7		1				7		1										
362	Blunn Creek - Preserve at Little Bridge													1									
180	Blunn Creek @ Riverside Drive																						
363	Blunn Creek @ Willow Run																						
364	Blunn Creek Above Stacy Pool																						
853	Boggy Creek @ Banton Road																				1		
784	North Boggy Creek @ Airport Rd.																						
493	North Boggy Creek @ Delwau Lane																						
837	Boggy Creek @ Nile Road																						
350	Bull Creek @ Loop 360 First Crossing								6														
920	Bull Creek @ St. Ed's Park above dam		1								16			1									
347	Bull Creek Above West Bull Creek		1								7							1					
151	Tributary 6 @ Bull Creek (EG)		5						13		55			33									
783	Buttermilk Creek @ Cameron Road																						
851	Buttermilk Creek @ Little Walnut													1									
782	Buttermilk Creek @ Providence Ave																						
850	Country Club Creek @ East Oltorf St																						
119	East Bouldin Creek @ Elizabeth St																						
115	East Bouldin Creek @ Riverside Dr																						
123	Fort Branch Creek @ Boggy Creek																						
126	Fort Branch Creek @ Glencrest Drive													23									
125	Fort Branch Creek Above Manor Rd																						
898	Ft. Branch @ Single Shot																						
877	Harper's Branch @ Windoak				1				1									2					
844	Harper's Branch @ Woodland																						
484	Harper's Branch Creek @ Riverside								1											1			
847	Johnson @ South Tarrytown				1																		
838	Little Walnut Creek @ Golden Meadow				2						1			1									
839	Little Walnut Creek @ Hermitage													1									
634	Little Walnut Creek @ US183				1													4					
840	Little Walnut Creek @ US290										1												
883	Onion Creek @ FM 973			1	18	1			4					6				11					
255	Onion Creek @ McKinney Falls		1		2				12					36				2					
220	Onion Creek @ Old Lockhart Hwy	15	5	1	27				94		2							1					
236	Onion Creek @ Twin Creek Bridge		24	2					19														
239	Onion Creek Above IH35 (OC2)	4	8	4					10		5			1		2	1				1		
116	Shoal Creek @ 24th St. (EII)		3								6			4		1					2		
118	Shoal Creek @ Crosscreek Drive		1								9			5									
117	Shoal Creek @ Shoal Edge Court				1						3			5							5		

Appendix E - 1996 EII Benthic Macroinvertebrate Data

Site #	Sample Site Name	Date	Dubiraphia	Dugesia	Dytiscidae	Elmidae	Empididae	Erpetogomphus	Erpobdellidae	Eulophidae	Eupharyphus	Fallceon	Gammarus	Gastropoda	Gerris	Glossiphonidae	Gomphidae	Gomphus	Hebetancylus	Hebrus	Helichus	Helicophyche	Helochares	Hemerodromia
122	Shoal Creek Above 1st St.	11/20/96		26					8			4				8			72			1		
842	Tannehill Creek @ Bartholomew Park	11/19/96										1				1								
854	Tannehill Creek @ Boggy Creek	11/18/96																						
841	Tannehill Creek @ Highland Mall	11/19/96		3												3			3					
843	Tannehill Creek @ Lovell Drive	11/19/96										16							4					
38	Waller Creek @ Ceasar Chavez	11/18/96							11			2							1					
624	Waller Creek @ 23rd St. (USGS)	11/19/96							4															
780	Waller Creek @ 51st Street	11/18/96							16							2			15					
781	Waller Creek @ Shipe Park	11/18/96		1					1							1								
659	Walnut Creek @ Lamar Blvd	11/20/96		41								202												
465	Walnut Creek @ Loyola	11/21/96		3								108												
503	Walnut Creek @ Railroad Bridge	11/21/96						3				49										7		
500	Walnut Creek @ Springdale Rd	11/20/96		4								59							1			2		1
464	Walnut Creek Below IH35	11/20/96		5				2														1		4
878	West Bouldin Creek @ Jewell	11/20/96		2								3												
223	Williamson Creek @ McKinney Falls	11/22/96		17					1										7			46		
492	Williamson Creek @ Nuckols Crossing	11/21/96										24							16			8		1
	Grand Totals		3	635	4	2	6	9	89	1	4	959	19	22	1	221	3	8	1097	2	6	276	1	31

Site #	Sample Site Name	Date	Heptageniidae	Hetaerina	Heterelmis	Hexacylloepus	Hexatoma	Hirudinea	Holorusia	Hyallela	Hydaticus	Hydracarina	Hydrochus	Hydrophilidae	Hydoptila	Laccophilus	Lepidoptera	Leptohypes	Leptophlebidae	Leucotrichia	Libellula	Libellulidae	Limnoporous	Limonia
122	Shoal Creek Above 1st St.	11/20/96													2							3		
842	Tannehill Creek @ Bartholomew Park	11/19/96																						
854	Tannehill Creek @ Boggy Creek	11/18/96																						
841	Tannehill Creek @ Highland Mall	11/19/96														1								
843	Tannehill Creek @ Lovell Drive	11/19/96																						
38	Waller Creek @ Ceasar Chavez	11/18/96																						
624	Waller Creek @ 23rd St. (USGS)	11/19/96																						
780	Waller Creek @ 51st Street	11/18/96													9									
781	Waller Creek @ Shipe Park	11/18/96		1								3					1							
659	Walnut Creek @ Lamar Blvd	11/20/96		2		2		1													1			
465	Walnut Creek @ Loyola	11/21/96				15									1						9			
503	Walnut Creek @ Railroad Bridge	11/21/96																						
500	Walnut Creek @ Springdale Rd	11/20/96		2								3							312			1		
464	Walnut Creek Below IH35	11/20/96																						
878	West Bouldin Creek @ Jewell	11/20/96																						
223	Williamson Creek @ McKinney Falls	11/22/96		1						70					18									2
492	Williamson Creek @ Nuckols Crossing	11/21/96		2				5		24	1	1												
	Grand Totals		19	61	10	99	1	23	1	256	2	242	1	9	173	1	4	9	333	2	12	14	1	2

Appendix E - 1996 EII Benthic Macroinvertebrate Data

Site #	Sample Site Name	Date	Lipogomphus	Lutrochus	Lymnaea	Lymnaeidae	Macrelmis	Mayatrichia	Mesovelia	Microcylloepus	Microvelia	Muscidae	Naucoridae	Nectopsyche	Nemotelus	Neoelmis	Neotrichia	Neurocordilia	Odontomyia	Oecetis	Oligochaeta	Oreodytes	Oromogomphus	Orthotrichia	Ostracoda	Oxytheria	Paracleodes	Paracymus	Peltodytes	Pericoma	Perlesta	Petrophila	Physidae	Planorbidae	Probezzia	Protoneuridae	Psephenus	Pseudoleon	Psychodidae	Rhagoionidae	Rhagovelia	Rhantus	Sciomyzidae	Scirtes	Simulium	Smicridia
48	Barton Creek @ 71 Below Little Barton	11/21/96															1				3				91							1	7	4												
88	Barton Creek @ Lost Creek Bridge	11/20/96					2			55						3					44			1	96							7	16	2			4								128	
82	Barton Creek Below Barton Creek Blvd	11/20/96				3				22									1		41				14								10	4							1				41	
362	Blunn Creek - Preserve at Little Bridge	11/19/96																			6												13	1								1				
180	Blunn Creek @ Riverside Drive	11/20/96				1															1																									
363	Blunn Creek @ Willow Run	11/19/96				1															2												3	2												
364	Blunn Creek Above Stacy Pool	11/20/96																			15												3													
853	Boggy Creek @ Banton Road	11/19/96																			24												58									1				
784	North Boggy Creek @ Airport Rd.	11/19/96																			14												6													
493	North Boggy Creek @ Delwau Lane	11/18/96																																												
837	Boggy Creek @ Nile Road	11/18/96																			2												5													
350	Bull Creek @ Loop 360 First Crossing	11/18/96				1								1						1	12											1	41	19			37								2	
920	Bull Creek @ St. Ed's Park above dam	11/20/96		3		1	34	9		406						8					12				5							5	51	1			2				1				86	
347	Bull Creek Above West Bull Creek	11/18/96		2						129						124									8							10		4			1								31	
151	Tributary 6 @ Bull Creek (EG)	11/19/96								3					1					1	9		1		24							30	1	2						20	60				35	
783	Buttermilk Creek @ Cameron Road	11/19/96																																												
851	Buttermilk Creek @ Little Walnut	11/20/96								1						1					7				1								2												1	
782	Buttermilk Creek @ Providence Ave	11/19/96														1					6																									
850	Country Club Creek @ East Oltorf St	11/19/96																			2												2				2									
119	East Bouldin Creek @ Elizabeth St	11/20/96																			2												13													
115	East Bouldin Creek @ Riverside Dr	11/20/96																			5																									
123	Fort Branch Creek @ Boggy Creek	11/18/96									2																																			
126	Fort Branch Creek @ Glencrest Drive	11/19/96																			25												3													
125	Fort Branch Creek Above Manor Rd	11/19/96									3										13												42													
898	Ft. Branch @ Single Shot	11/22/96																									1																			
877	Harper's Branch @ Windoak	11/19/96				1															14												10	6			1									
844	Harper's Branch @ Woodland	11/19/96																			8												10													
484	Harper's Branch Creek @ Riverside	11/19/96																			77									1			7	2			1									
847	Johnson @ South Tarrytown	11/20/96																			2				4								85												1	
838	Little Walnut Creek @ Golden Meadow	11/20/96																			17											3	1													
839	Little Walnut Creek @ Hermitage	11/20/96														4					1											2	1												6	
634	Little Walnut Creek @ US183	11/21/96																															12												2	
840	Little Walnut Creek @ US290	11/21/96		1			3			13											17				14								3	1											6	1
883	Onion Creek @ FM 973	11/18/96				3	2			15						6				9	11																698								1	
255	Onion Creek @ McKinney Falls	11/18/96				32				12	1	1		2						15	18				4							46		1			190				1				17	
220	Onion Creek @ Old Lockhart Hwy	11/18/96				23	3			67						6			2	3	46				13							7	1	5		2	381							8	13	
236	Onion Creek @ Twin Creek Bridge	11/18/96				1				33										1	18				29							1	77	2			3							1	20	
239	Onion Creek Above IH35 (OC2)	11/18/96				2	14			19						3				1	131				2							3				1	69								103	
116	Shoal Creek @ 24th St. (EII)	11/19/96																			24				28			1					85	5		2									2	
118	Shoal Creek @ Crosscreek Drive	11/19/96																			59				9																					
117	Shoal Creek @ Shoal Edge Court	11/18/96																			41				6							5	55	4											11	1

Appendix E - 1996 EII Benthic Macroinvertebrate Data

Site #	Sample Site Name	Date	Lipogomphus	Lutrochus	Lymnaea	Lymnaeidae	Macrelmis	Mayatrichia	Mesovelia	Microcylloepus	Microvelia	Muscidae	Naucoridae	Nectopsyche	Nemotelus	Neoelmis	Neotrichia	Neurocordilia	Odontomyia	Oecetis	Oligochaeta	Oreodytes	Oromogomphus	Orthotrichia	Ostracoda	Oxytheria	Paracleodes	Paracymus	Peltodytes	Pericoma	Perlesta	Petrophila	Physidae	Planorbidae	Probezzia	Protoneuridae	Psephenus	Pseudoleon	Psychodidae	Rhagoionidae	Rhagovelia	Rhantus	Sciomyzidae	Scirtes	Simulium	Smicridia
122	Shoal Creek Above 1st St.	11/20/96				3															145												249	3					2						1	
842	Tannehill Creek @ Bartholomew Park	11/19/96																			1																									
854	Tannehill Creek @ Boggy Creek	11/18/96																			7														1											
841	Tannehill Creek @ Highland Mall	11/19/96				6															52												11			1										
843	Tannehill Creek @ Lovell Drive	11/19/96				2															6												7												1	
38	Waller Creek @ Ceasar Chavez	11/18/96																																											4	
624	Waller Creek @ 23rd St. (USGS)	11/19/96	1																		13												1												1	
780	Waller Creek @ 51st Street	11/18/96				1															48												156			1							1		5	
781	Waller Creek @ Shipe Park	11/18/96				1			1		1										38												12													
659	Walnut Creek @ Lamar Blvd	11/20/96				3	30			32																						1	1				62				5				11	
465	Walnut Creek @ Loyola	11/21/96					12			11						5					20												3				11				3				111	4
503	Walnut Creek @ Railroad Bridge	11/21/96					1			3						1					5																3								1	20
500	Walnut Creek @ Springdale Rd	11/20/96					17			77				2		19									3						1		1				16								197	24
464	Walnut Creek Below IH35	11/20/96				1	3			1																						2	1	1			59								6	
878	West Bouldin Creek @ Jewell	11/20/96									1										4						1										2									
223	Williamson Creek @ McKinney Falls	11/22/96				29				3		1		1					2	1	12	1			3				10	1			32	8			25		1			2			7	
492	Williamson Creek @ Nuckols Crossing	11/21/96				3				2											29			3	4							8	27	3			4				29				12	
	Grand Totals		1	6	9	118	121	9	1	910	26	2	7	6	1	181	1	1	5	32	1190	1	1	4	397	1	2	2	10	2	1	147	1148	81	1	7	1571	3	3	21	105	4	1	10	1369	50

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	ACHNANTHES AMOENA	ACHNANTHES BIASOLETTIANA	ACHNANTHES CURTISSIMA	ACHNANTHES DELICATULA	ACHNANTHES EXIGUA	ACHNANTHES GRISCHUNA	ACHNANTHES LANCEOLATA	ACHNANTHES LANCEOLATA V. DUBIA	ACHNANTHES MINUTISSIMA	ACHNANTHES ROSENSTOCKII	ACHNANTHES SUBATOMOIDES	ACHNANTHES THERMALIS	AMPHIPLEURA LINDHEIMERI	AMPHIPLEURA PELLUCIDA	AMPHORA COFFEAEFORMIS	AMPHORA LIBYCA	AMPHORA MONTANA	AMPHORA OVALIS	AMPHORA PEDICULUS	AMPHORA PERPUSILLA	AMPHORA VENETA	ANOMOENEIS BRACHYSIRA
48	Barton @ 71 Below Little Barton	11/21/96	0	35	0	0	0	0	0	0	220	0	0	0	0	21	0	0	0	0	0	0	0	0
88	Barton Creek @ Lost Creek Bridge	11/20/96	0	0	0	0	3	0	0	0	111	0	0	34	0	0	0	0	0	0	10	0	0	0
82	Barton Below Barton Creek Blvd	11/20/96	0	1	0	0	1	0	0	0	260	0	0	0	0	18	0	0	0	0	14	0	0	0
362	Blunn Creek - Preserve	11/19/96	0	0	0	0	2	0	0	0	154	0	0	0	0	6	0	6	2	0	2	0	0	0
180	Blunn Creek @ Riverside Drive	11/20/96	0	0	0	0	4	0	2	0	10	0	0	0	0	0	0	6	0	0	30	0	0	0
363	Blunn Creek @ Willow Run	11/19/96	0	0	0	0	0	66	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
364	Blunn Creek Above Stacy Pool	11/20/96	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	124	0	0	0
364	Blunn Creek Above Stacy Pool	11/20/96	0	0	0	0	0	0	2	0	4	0	0	0	0	2	0	0	0	0	153	0	0	0
364	Blunn Creek Above Stacy Pool	11/20/96	0	0	0	0	1	0	0	0	5	0	0	0	2	0	0	0	3	0	0	154	0	0
853	Boggy Creek @ Banton Road	11/19/96	0	0	0	0	66	16	6	0	20	0	0	0	0	0	0	0	2	0	104	0	0	0
837	Boggy Creek @ Nile Road	11/18/96	0	0	0	0	66	0	0	0	0	0	0	0	0	0	0	0	8	0	8	0	0	0
837	Boggy Creek @ Nile Road	11/18/96	0	0	0	0	30	0	0	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0
837	Boggy Creek @ Nile Road	11/18/96	0	0	0	0	50	0	0	4	0	0	0	0	0	0	0	0	2	0	0	2	0	0
784	North Boggy Creek @ Airport Rd.	11/19/96	0	0	0	0	30	0	1	0	0	0	0	0	0	0	0	0	0	0	45	0	0	0
493	North Boggy Creek @ Delwau Lane	11/18/96	0	0	0	0	8	0	0	0	3	0	0	8	0	0	0	0	0	0	4	0	0	0
350	Bull Creek @ 360 First Crossing	11/18/96	0	0	0	0	0	0	0	0	277	0	0	12	0	8	0	0	1	0	2	0	0	0
350	Bull Creek @ 360 First Crossing	11/18/96	0	0	0	0	2	0	0	0	320	0	0	19	0	2	0	0	2	0	0	0	0	0
920	Bull Creek @ St. Ed's Park above dam	11/20/96	0	25	0	0	0	0	0	0	181	0	0	0	0	8	0	0	0	0	0	0	0	0
347	Bull Creek Above West Bull Creek	11/18/96	0	2	0	0	1	0	0	0	241	0	0	0	0	0	0	0	0	0	0	0	0	0
151	Tributary 6 @ Bull Creek (EG)	11/19/96	0	0	0	0	0	0	1	0	223	0	0	0	0	0	0	0	0	0	121	0	1	0
151	Tributary 6 @ Bull Creek (EG)	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
783	Buttermilk Creek @ Cameron Road	11/19/96	0	0	0	0	6	0	0	0	64	0	0	0	0	6	0	0	5	0	23	0	0	0
851	Buttermilk @ Little Walnut Creek	11/20/96	0	7	0	0	2	0	0	0	291	0	0	0	0	0	0	0	16	0	40	0	0	0
782	Buttermilk Creek @ Providence Ave	11/19/96	0	7	0	0	71	0	0	0	0	0	0	7	0	0	0	0	11	0	1	0	0	0
850	Country Club Creek @ East Oltorf St	11/19/96	0	0	0	0	38	0	21	0	33	0	0	0	0	0	0	0	4	0	87	0	0	0

Appendix E - 1996 EII Diatom Data (Counts)

Site #	Sample Site Name	Date	ACHNANTHES AMOENA	ACHNANTHES BIASOLETTIANA	ACHNANTHES CURTISSIMA	ACHNANTHES DELICATULA	ACHNANTHES EXIGUA	ACHNANTHES GRISCHUNA	ACHNANTHES LANCEOLATA	ACHNANTHES LANCEOLATA V. DUBIA	ACHNANTHES MINUTISSIMA	ACHNANTHES ROSENSTOCKII	ACHNANTHES SUBATOMOIDES	ACHNANTHES THERMALIS	AMPHIPLEURA LINDHEIMERI	AMPHIPLEURA PELLUCIDA	AMPHORA COFFEAEFORMIS	AMPHORA LIBYCA	AMPHORA MONTANA	AMPHORA OVALIS	AMPHORA PEDICULUS	AMPHORA PERPUSILLA	AMPHORA VENETA	ANOMOENEIS BRACHYSIRA
119	**East Bouldin Creek @ Elizabeth St**	**11/20/96**	0	0	0	0	49	0	11	0	6	0	0	0	0	0	0	0	2	0	41	0	0	0
115	**East Bouldin Creek @ Riverside Dr**	**11/20/96**	0	0	0	0	56	0	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0	0
123	**Fort Branch Creek @ Boggy Creek**	**11/18/96**	0	0	0	0	7	0	0	0	294	0	0	0	0	1	0	0	8	0	63	0	0	0
126	**Fort Branch Creek @ Glencrest Dr**	**11/19/96**	0	0	0	0	9	0	0	0	2	0	0	0	0	0	0	0	2	0	22	0	0	0
125	**Fort Branch Creek Above Manor Rd**	**11/19/96**	0	0	0	0	63	0	6	0	6	0	0	0	0	0	0	0	13	0	17	0	0	0
898	**Ft. Branch @ Single Shot**	**11/22/96**	0	1	0	0	16	0	1	0	8	0	0	0	0	0	0	0	41	0	1	0	0	0
877	**Harper's Branch @ Windoak**	**11/19/96**	0	0	0	0	5	0	4	0	0	0	0	0	0	0	0	0	0	0	332	0	0	0
844	**Harper's Branch @ Woodland**	**11/19/96**	0	0	0	0	9	0	4	0	0	0	0	0	0	0	0	0	0	0	41	0	0	0
484	**Harper's Branch Creek @ Riverside**	**11/19/96**	0	0	0	0	3	0	1	0	0	0	0	0	0	0	9	0	8	0	130	0	0	0
847	**Johnson @ South Tarrytown**	**11/20/96**	0	0	0	0	50	0	28	0	2	0	0	0	0	0	0	0	18	0	0	0	0	0
847	**Johnson @ South Tarrytown**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	**Little Walnut @ Golden Meadow**	**11/20/96**	0	0	0	0	10	0	0	0	14	0	0	0	0	4	0	0	0	0	0	0	0	0
839	**Little Walnut Creek @ Hermitage**	**11/20/96**	0	22	0	0	0	0	0	0	360	0	0	0	0	0	0	0	2	0	0	0	0	0
634	**Little Walnut Creek @ US183**	**11/21/96**	0	23	0	0	2	0	0	0	404	0	0	0	0	0	0	0	12	0	0	0	0	0
634	**Little Walnut Creek @ US183**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	**Little Walnut Creek @ US290**	**11/21/96**	0	0	0	0	0	0	0	0	193	0	0	5	0	1	0	0	2	0	0	0	1	0
883	**Onion Creek @ FM 973**	**11/18/96**	0	7	0	0	2	0	0	0	34	0	0	0	0	13	0	0	0	0	8	0	0	0
883	**Onion Creek @ FM 973**	**11/18/96**	0	3	0	0	0	0	0	0	19	0	0	0	0	20	0	0	0	0	14	0	0	0
255	**Onion Creek @ McKinney Falls**	**11/18/96**	0	0	0	0	2	0	2	0	160	0	0	0	0	2	0	0	0	0	20	0	6	0
255	**Onion Creek @ McKinney Falls**	**11/18/96**	0	0	0	0	0	0	0	0	206	4	0	0	0	2	0	0	0	2	0	14	5	0
220	**Onion Creek @ Old Lockhart Hwy**	**11/18/96**	0	0	0	0	1	0	0	0	0	0	0	0	0	15	0	0	2	0	7	0	3	0
236	**Onion Creek @ Twin Creek Bridge**	**11/18/96**	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	26	0	5	0	24	0
236	**Onion Creek @ Twin Creek Bridge**	**11/18/96**	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	8	0	0	20	20	0
239	**Onion Creek Above IH35 (OC2)**	**11/18/96**	0	0	0	0	2	0	1	0	95	0	0	0	0	12	0	0	0	0	6	0	6	0
239	**Onion Creek Above IH35 (OC2)**	**11/18/96**	0	0	0	0	0	0	0	0	52	0	0	0	0	3	0	0	0	0	0	2	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	ACHNANTHES AMOENA	ACHNANTHES BIASOLETTIANA	ACHNANTHES CURTISSIMA	ACHNANTHES DELICATULA	ACHNANTHES EXIGUA	ACHNANTHES GRISCHUNA	ACHNANTHES LANCEOLATA	ACHNANTHES LANCEOLATA V. DUBIA	ACHNANTHES MINUTISSIMA	ACHNANTHES ROSENSTOCKII	ACHNANTHES SUBATOMOIDES	ACHNANTHES THERMALIS	AMPHIPLEURA LINDHEIMERI	AMPHIPLEURA PELLUCIDA	AMPHORA COFFEAEFORMIS	AMPHORA LIBYCA	AMPHORA MONTANA	AMPHORA OVALIS	AMPHORA PEDICULUS	AMPHORA PERPUSILLA	AMPHORA VENETA	ANOMOENEIS BRACHYSIRA
116	**Shoal Creek @ 24th St. (EII)**	**11/19/96**	0	0	0	0	3	0	0	0	82	0	0	0	0	0	0	0	0	0	0	0	0	0
117	**Shoal Creek @ Shoal Edge Court**	**11/18/96**	0	5	0	0	67	0	1	0	15	0	0	0	0	0	0	0	2	0	16	0	0	0
122	**Shoal Creek Above 1st St.**	**11/20/96**	0	0	0	0	8	0	0	0	12	0	0	0	0	0	0	0	0	0	2	0	16	0
842	**Tannehill Creek @ Bartholomew Park**	**11/19/96**	0	0	0	0	17	0	0	0	2	0	0	0	0	0	0	0	31	0	5	0	0	0
854	**Tannehill Creek @ Boggy Creek**	**11/18/96**	0	0	0	0	60	0	0	0	1	0	0	0	0	0	0	0	7	0	0	0	0	0
841	**Tannehill Creek @ Highland Mall**	**11/19/96**	0	0	0	0	41	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
843	**Tannehill Creek @ Lovell Drive**	**11/19/96**	0	0	0	0	55	0	1	0	6	0	0	0	0	0	0	0	5	0	135	0	0	0
38	**Waller Creek @ Ceasar Chavez**	**11/18/96**	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	11	0
624	**Waller Creek @ 23rd St. (USGS)**	**11/19/96**	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	18	0	2	0	14	0
780	**Waller Creek @ 51st Street**	**11/18/96**	0	0	0	0	80	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0
781	**Waller Creek @ Shipe Park**	**11/18/96**	0	0	0	0	79	0	0	0	4	0	0	0	0	0	0	0	0	0	4	0	0	0
659	**Walnut Creek @ Lamar Blvd**	**11/20/96**	0	0	0	0	5	0	3	0	100	0	0	0	0	3	0	0	2	0	35	0	3	0
465	**Walnut Creek @ Loyola**	**11/21/96**	0	22	0	0	2	0	2	0	36	0	0	0	0	0	0	0	8	0	24	0	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	29	0	0	0	56	0	0	0	0	0	0	0	21	0	3	0	2	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	48	0	0	6	0	10	0	46	0	0	0	0	0	0	0	42	0	30	0	6	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	6	0	0	3	79	0	0	0	0	0	0	0	34	0	0	30	2	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
464	**Walnut Creek Below IH35**	**11/20/96**	0	0	0	0	3	0	8	0	77	0	0	0	0	0	0	0	0	0	74	0	6	0
878	**West Bouldin Creek @ Jewell**	**11/20/96**	0	3	0	0	19	0	15	0	9	0	0	0	0	0	0	0	18	0	54	0	0	0
223	**Williamson Creek @ McKinney Falls**	**11/22/96**	0	0	0	0	2	0	0	0	199	0	0	0	0	0	0	0	4	0	34	0	3	0
492	**Williamson @ Nuckols Crossing**	**11/21/96**	0	7	0	0	9	0	3	0	126	0	0	0	0	0	0	0	0	0	163	0	1	0
			2	234	2	22	1351	226	220	7	9333.5	4	96	85	2	274	9	16	557	2	2721	222	132	8

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	ANOMONEIS VITREA	BACILLARIA PARADOXA	CALONEIS BACILLUM	CALONEIS MOLARIS	CALONEIS SCHUMANNIANA	CALONEIS SILICULA	COCCONEIS PEDICULUS	COCCONEIS PLACENTULA	CYCLOTELLA BODANICA	CYCLOTELLA MENENGHINIANA	CYMATOPLEURA SOLEA	CYMBELLA AFFINIS	CYMBELLA AMPHICEPHALA	CYMBELLA ASPERA	CYMBELLA BREHMII	CYMBELLA CISTULA	CYMBELLA CYMBIFORMIS	CYMBELLA DELICATULA	CYMBELLA DESCRIPTA	CYMBELLA GAEUMANNII	CYMBELLA GRACILIS	CYMBELLA HUSTEDTII	CYMBELLA LAEVIS	CYMBELLA LEPTOCEROS
48	**Barton @ 71 Below Little Barton**	**11/21/96**	17	0	0	0	0	0	0	0	0	1	0	3	0	0	0	14	0	0	0	87	2	0	0	0
88	**Barton Creek @ Lost Creek Bridge**	**11/20/96**	12	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	4	0	140	0	0	0	0
82	**Barton Below Barton Creek Blvd**	**11/20/96**	19	0	1	0	0	1	0	0	0	1	2	0	0	0	0	2	0	1	0	16	0	0	0	0
362	**Blunn Creek - Preserve**	**11/19/96**	0	0	6	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
180	**Blunn Creek @ Riverside Drive**	**11/20/96**	0	28	0	0	6	0	0	2	0	0	4	0	0	0	0	0	0	60	0	0	0	0	0	0
363	**Blunn Creek @ Willow Run**	**11/19/96**	6	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
853	**Boggy Creek @ Banton Road**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	4	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
784	**North Boggy Creek @ Airport Rd.**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
493	**North Boggy Creek @ Delwau Lane**	**11/18/96**	0	0	20	0	0	3	0	0	0	1	0	20	0	0	0	0	0	1	0	5	0	0	0	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	1	2	0	0	0	0	65	30	0	1	0	14	0	0	0	1	0	0	0	14	0	0	0	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	6	0	0	0	0	0	29	29	0	1	0	9	0	0	0	1	0	1	0	22	0	0	0	0
920	**Bull Creek @ St. Ed's Park above dam**	**11/20/96**	22	0	0	0	2	0	0	1	0	2	0	9	0	0	0	0	0	2	0	82	0	0	0	0
347	**Bull Creek Above West Bull Creek**	**11/18/96**	11	0	0	0	0	0	0	0	0	0	0	5	0	0	0	2	0	6	3	103	0	0	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	0	0	0	0	19	39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
783	**Buttermilk Creek @ Cameron Road**	**11/19/96**	1	0	4	0	0	0	0	1	0	3	0	14	0	0	0	0	0	0	0	0	0	0	0	0
851	**Buttermilk @ Little Walnut Creek**	**11/20/96**	0	0	2	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0
782	**Buttermilk Creek @ Providence Ave**	**11/19/96**	0	0	7	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
850	**Country Club Creek @ East Oltorf St**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	ANOMONEIS VITREA	BACILLARIA PARADOXA	CALONEIS BACILLUM	CALONEIS MOLARIS	CALONEIS SCHUMANNIANA	CALONEIS SILICULA	COCCONEIS PEDICULUS	COCCONEIS PLACENTULA	CYCLOTELLA BODANICA	CYCLOTELLA MENENGHINIANA	CYMATOPLEURA SOLEA	CYMBELLA AFFINIS	CYMBELLA AMPHICEPHALA	CYMBELLA ASPERA	CYMBELLA BREHMII	CYMBELLA CISTULA	CYMBELLA CYMBIFORMIS	CYMBELLA DELICATULA	CYMBELLA DESCRIPTA	CYMBELLA GAEUMANNII	CYMBELLA GRACILIS	CYMBELLA HUSTEDTII	CYMBELLA LAEVIS	CYMBELLA LEPTOCEROS
119	**East Bouldin Creek @ Elizabeth St**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	**East Bouldin Creek @ Riverside Dr**	**11/20/96**	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	**Fort Branch Creek @ Boggy Creek**	**11/18/96**	2	0	2	0	2	1	0	0	0	1	0	6	0	0	0	0	0	1	0	3	0	0	0	0
126	**Fort Branch Creek @ Glencrest Dr**	**11/19/96**	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
125	**Fort Branch Creek Above Manor Rd**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
898	**Ft. Branch @ Single Shot**	**11/22/96**	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0
877	**Harper's Branch @ Windoak**	**11/19/96**	0	0	0	0	0	0	0	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
844	**Harper's Branch @ Woodland**	**11/19/96**	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
484	**Harper's Branch Creek @ Riverside**	**11/19/96**	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
847	**Johnson @ South Tarrytown**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0	0
847	**Johnson @ South Tarrytown**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	**Little Walnut @ Golden Meadow**	**11/20/96**	0	0	4	0	0	0	0	0	0	4	0	14	0	0	0	0	0	0	0	0	0	0	0	0
839	**Little Walnut Creek @ Hermitage**	**11/20/96**	0	0	0	0	0	0	0	0	0	2	0	18	0	0	0	0	0	0	0	0	0	0	0	0
634	**Little Walnut Creek @ US183**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
634	**Little Walnut Creek @ US183**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	**Little Walnut Creek @ US290**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	6	0	0	0	0
883	**Onion Creek @ FM 973**	**11/18/96**	2	0	12	0	0	0	0	30	0	3	0	7	0	0	0	0	0	0	0	0	0	0	0	0
883	**Onion Creek @ FM 973**	**11/18/96**	1	0	11	0	2	0	0	15	0	1	1	8	0	0	0	0	0	0	0	0	0	0	0	0
255	**Onion Creek @ McKinney Falls**	**11/18/96**	0	0	0	0	0	0	0	8	0	4	0	10	0	0	0	0	0	2	4	0	6	0	0	0
255	**Onion Creek @ McKinney Falls**	**11/18/96**	2	2	1	0	0	0	10	14	0	0	0	6	0	0	0	0	0	0	0	6	0	2	2	0
220	**Onion Creek @ Old Lockhart Hwy**	**11/18/96**	0	0	0	0	0	0	0	296	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
236	**Onion Creek @ Twin Creek Bridge**	**11/18/96**	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
236	**Onion Creek @ Twin Creek Bridge**	**11/18/96**	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
239	**Onion Creek Above IH35 (OC2)**	**11/18/96**	0	0	0	0	0	0	0	193	0	0	0	0	0	0	0	2	0	0	0	36	0	0	0	0
239	**Onion Creek Above IH35 (OC2)**	**11/18/96**	1	0	0	0	0	0	0	282	0	2	0	4	0	2	0	0	0	0	0	11	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	ANOMONEIS VITREA	BACILLARIA PARADOXA	CALONEIS BACILLUM	CALONEIS MOLARIS	CALONEIS SCHUMANNIANA	CALONEIS SILICULA	COCCONEIS PEDICULUS	COCCONEIS PLACENTULA	CYCLOTELLA BODANICA	CYCLOTELLA MENENGHINIANA	CYMATOPLEURA SOLEA	CYMBELLA AFFINIS	CYMBELLA AMPHICEPHALA	CYMBELLA ASPERA	CYMBELLA BREHMII	CYMBELLA CISTULA	CYMBELLA CYMBIFORMIS	CYMBELLA DELICATULA	CYMBELLA DESCRIPTA	CYMBELLA GAEUMANNII	CYMBELLA GRACILIS	CYMBELLA HUSTEDTII	CYMBELLA LAEVIS	CYMBELLA LEPTOCEROS
116	**Shoal Creek @ 24th St. (EII)**	**11/19/96**	0	0	4	0	0	0	0	0	0	13	0	10	0	0	0	0	0	0	0	0	0	0	0	0
117	**Shoal Creek @ Shoal Edge Court**	**11/18/96**	0	0	1	0	0	0	0	43	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0
122	**Shoal Creek Above 1st St.**	**11/20/96**	0	0	8	0	2	0	0	3	0	38	0	12	0	0	0	0	0	0	0	0	0	0	0	0
842	**Tannehill Creek @ Bartholomew Park**	**11/19/96**	0	0	0	0	0	0	0	1	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
854	**Tannehill Creek @ Boggy Creek**	**11/18/96**	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
841	**Tannehill Creek @ Highland Mall**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
843	**Tannehill Creek @ Lovell Drive**	**11/19/96**	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	**Waller Creek @ Ceasar Chavez**	**11/18/96**	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
624	**Waller Creek @ 23rd St. (USGS)**	**11/19/96**	2	0	6	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
780	**Waller Creek @ 51st Street**	**11/18/96**	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
781	**Waller Creek @ Shipe Park**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
659	**Walnut Creek @ Lamar Blvd**	**11/20/96**	0	1	2	0	0	0	14	42	0	3	0	2	0	0	0	0	0	1	0	0	0	0	0	0
465	**Walnut Creek @ Loyola**	**11/21/96**	0	0	0	0	0	0	0	46	0	4	0	2	0	0	0	0	0	0	0	0	0	0	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	5	0	0	0	0	22	0	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
464	**Walnut Creek Below IH35**	**11/20/96**	0	2	0	0	0	0	0	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
878	**West Bouldin Creek @ Jewell**	**11/20/96**	0	0	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
223	**Williamson Creek @ McKinney Falls**	**11/22/96**	0	3	0	0	0	0	24	0	0	6	0	5	0	0	0	0	0	0	0	0	0	0	0	0
492	**Williamson @ Nuckols Crossing**	**11/21/96**	0	1	0	0	0	0	7	56	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			375	41	135	26	23	15	168	1425	2	226	8	597	26	2	2	24	4	307	7	533	32	2	3	6

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	CYMBELLA MICROCEPHALA	CYMBELLA MINUTA	CYMBELLA MINUTA V. SILESIACA	CYMBELLA PUSILLA	CYMBELLA SILESIACA	CYMBELLA SUBAEQUALIS	CYMBELLA TUMIDULA	CYMBELLA TURGIDULA	DENTICULA KUETZINGII	DIATOMA MONILIFORMIS	DIATOMA VULGARIS	DIPLONEIS ELLIPTICA	DIPLONEIS OVALIS	DIPLONEIS PUELLA	EPITHEMIA ADNATA	EPITHEMIA SOREX	EUNOTIA BILUNARIS	EUNOTIA FORMICA	EUNOTIA MINOR	EUNOTIA PALUDOSA	FRAGILARIA ACUS	FRAGILARIA CAPUCINA	FRAGILARIA CONSTRUENS	FRAGILARIA DELICATISSIMA
48	**Barton @ 71 Below Little Barton**	**11/21/96**	12	0	0	0	3	0	0	0	11	0	0	1	0	0	0	0	0	0	0	0	0	12	0	0
88	**Barton Creek @ Lost Creek Bridge**	**11/20/96**	0	0	0	0	2	7	0	0	8	0	0	1	0	0	0	0	0	0	0	0	0	6	0	0
82	**Barton Below Barton Creek Blvd**	**11/20/96**	0	0	0	0	4	0	0	0	4	0	0	8	0	0	0	0	0	0	0	0	0	1	0	0
362	**Blunn Creek - Preserve**	**11/19/96**	0	0	0	0	12	0	0	0	8	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
180	**Blunn Creek @ Riverside Drive**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0
363	**Blunn Creek @ Willow Run**	**11/19/96**	0	0	0	0	0	0	0	0	22	0	0	24	0	0	0	0	0	0	0	10	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	0	0	4	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
853	**Boggy Creek @ Banton Road**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
784	**North Boggy Creek @ Airport Rd.**	**11/19/96**	0	0	0	0	0	0	0	0	7	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0
493	**North Boggy Creek @ Delwau Lane**	**11/18/96**	0	45	0	0	107	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	0	6	0	0	3	0	2	0	11	0	0	2	0	0	0	2	0	0	0	0	0	2	0	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	0	6	0	0	2	0	8	0	3	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
920	**Bull Creek @ St. Ed's Park above dam**	**11/20/96**	12	4	0	0	6	0	0	0	20	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0
347	**Bull Creek Above West Bull Creek**	**11/18/96**	5	7	0	0	6	0	0	7	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	0	0	0	0	0	0	29	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
783	**Buttermilk Creek @ Cameron Road**	**11/19/96**	0	0	0	0	8	0	0	0	11	2	0	7	0	0	0	0	0	0	0	0	0	2	0	0
851	**Buttermilk @ Little Walnut Creek**	**11/20/96**	0	0	0	0	8	0	0	4	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
782	**Buttermilk Creek @ Providence Ave**	**11/19/96**	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
850	**Country Club Creek @ East Oltorf St**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	CYMBELLA MICROCEPHALA	CYMBELLA MINUTA	CYMBELLA MINUTA V. SILESIACA	CYMBELLA PUSILLA	CYMBELLA SILESIACA	CYMBELLA SUBAEQUALIS	CYMBELLA TUMIDULA	CYMBELLA TURGIDULA	DENTICULA KUETZINGII	DIATOMA MONILIFORMIS	DIATOMA VULGARIS	DIPLONEIS ELLIPTICA	DIPLONEIS OVALIS	DIPLONEIS PUELLA	EPITHEMIA ADNATA	EPITHEMIA SOREX	EUNOTIA BILUNARIS	EUNOTIA FORMICA	EUNOTIA MINOR	EUNOTIA PALUDOSA	FRAGILARIA ACUS	FRAGILARIA CAPUCINA	FRAGILARIA CONSTRUENS	FRAGILARIA DELICATISSIMA
119	East Bouldin Creek @ Elizabeth St	11/20/96	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
115	East Bouldin Creek @ Riverside Dr	11/20/96	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	Fort Branch Creek @ Boggy Creek	11/18/96	0	2	0	0	3	0	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
126	Fort Branch Creek @ Glencrest Dr	11/19/96	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
125	Fort Branch Creek Above Manor Rd	11/19/96	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
898	Ft. Branch @ Single Shot	11/22/96	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
877	Harper's Branch @ Windoak	11/19/96	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
844	Harper's Branch @ Woodland	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
484	Harper's Branch Creek @ Riverside	11/19/96	0	0	0	0	0	0	0	0	0	2	0	37	0	0	0	0	0	0	0	0	0	0	0	0
847	Johnson @ South Tarrytown	11/20/96	0	0	0	0	0	0	0	0	2	0	0	86	0	0	0	0	0	0	0	0	0	0	0	0
847	Johnson @ South Tarrytown	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	Little Walnut @ Golden Meadow	11/20/96	0	0	0	0	8	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
839	Little Walnut Creek @ Hermitage	11/20/96	0	0	0	0	16	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	Little Walnut Creek @ US290	11/21/96	0	1	0	0	10	0	25	0	50	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
883	Onion Creek @ FM 973	11/18/96	0	2	0	0	26	0	0	0	1	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
883	Onion Creek @ FM 973	11/18/96	0	4	0	0	27	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
255	Onion Creek @ McKinney Falls	11/18/96	4	4	0	0	4	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
255	Onion Creek @ McKinney Falls	11/18/96	8	10	2	0	0	0	0	0	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
220	Onion Creek @ Old Lockhart Hwy	11/18/96	0	0	0	0	2	0	0	0	3	0	0	1	0	0	5	0	0	0	0	0	0	0	0	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	0	3	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
239	Onion Creek Above IH35 (OC2)	11/18/96	0	0	0	0	4	0	0	0	6	0	0	2	0	0	4	0	0	0	0	0	0	0	10	0
239	Onion Creek Above IH35 (OC2)	11/18/96	1	0	4	0	0	0	0	0	5	0	0	2	0	2	5	0	0	0	0	0	1	0	19	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	CYMBELLA MICROCEPHALA	CYMBELLA MINUTA	CYMBELLA MINUTA V. SILESIACA	CYMBELLA PUSILLA	CYMBELLA SILESIACA	CYMBELLA SUBAEQUALIS	CYMBELLA TUMIDULA	CYMBELLA TURGIDULA	DENTICULA KUETZINGII	DIATOMA MONILIFORMIS	DIATOMA VULGARIS	DIPLONEIS ELLIPTICA	DIPLONEIS OVALIS	DIPLONEIS PUELLA	EPITHEMIA ADNATA	EPITHEMIA SOREX	EUNOTIA BILUNARIS	EUNOTIA FORMICA	EUNOTIA MINOR	EUNOTIA PALUDOSA	FRAGILARIA ACUS	FRAGILARIA CAPUCINA	FRAGILARIA CONSTRUENS	FRAGILARIA DELICATISSIMA
116	**Shoal Creek @ 24th St. (EII)**	**11/19/96**	0	0	0	0	58	0	0	2	19	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0
117	**Shoal Creek @ Shoal Edge Court**	**11/18/96**	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
122	**Shoal Creek Above 1st St.**	**11/20/96**	0	6	0	0	36	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0
842	**Tannehill Creek @ Bartholomew Park**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
854	**Tannehill Creek @ Boggy Creek**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
841	**Tannehill Creek @ Highland Mall**	**11/19/96**	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
843	**Tannehill Creek @ Lovell Drive**	**11/19/96**	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	**Waller Creek @ Ceasar Chavez**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
624	**Waller Creek @ 23rd St. (USGS)**	**11/19/96**	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
780	**Waller Creek @ 51st Street**	**11/18/96**	0	0	0	0	2	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
781	**Waller Creek @ Shipe Park**	**11/18/96**	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
659	**Walnut Creek @ Lamar Blvd**	**11/20/96**	0	1	0	0	9	0	5	0	8	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
465	**Walnut Creek @ Loyola**	**11/21/96**	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	4	0	0	13	0	0	0	11	0	0	39	0	0	0	0	0	0	6	0	0	0	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
464	**Walnut Creek Below IH35**	**11/20/96**	0	0	0	0	6	0	0	2	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
878	**West Bouldin Creek @ Jewell**	**11/20/96**	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
223	**Williamson Creek @ McKinney Falls**	**11/22/96**	0	0	0	0	7	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
492	**Williamson @ Nuckols Crossing**	**11/21/96**	0	1	0	0	2	0	0	0	3	0	0	0	0	0	3	10	0	0	0	0	0	4	0	0
			234	450	6	1	818	7	126	27	550	4	10	314	4	2	17	14	12	2	8	10	1	139	31	2

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	FRAGILARIA FASCICULATA	FRAGILARIA PULCHELLA	FRAGILARIA ULNA	GOMPHONEMA ACUMINATUM	GOMPHONEMA ANGUSTUM	GOMPHONEMA AQUAEMINERALIS	GOMPHONEMA CLAVATUM	GOMPHONEMA DICHOTOMUM	GOMPHONEMA GRACILE	GOMPHONEMA GROVEI	GOMPHONEMA INSIGNE	GOMPHONEMA MINUTUM	GOMPHONEMA PARVULUM	GOMPHONEMA PSEUDOAUGUR	GOMPHONEMA RHOMBICUM	GOMPHONEMA SP. 1	GOMPHONEMA TRUNCATUM	GYROSIGMA ATTENUATUM	GYROSIGMA NODIFERUM	GYROSIGMA SCALPROIDES	HANTZSCHIA AMPHIOXYS	MARILIA	MASTOGLOIA SMITHII	MELOSIRA LINEATA	MELOSIRA VARIANS	NAVICULA ABSOLUTA
48	**Barton @ 71 Below Little Barton**	**11/21/96**	0	0	2	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	3	0	0	0
88	**Barton Creek @ Lost Creek Bridge**	**11/20/96**	0	0	91	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
82	**Barton Below Barton Creek Blvd**	**11/20/96**	0	0	7	0	0	0	19	0	1	2	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
362	**Blunn Creek - Preserve**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	2	0	0	0	0	0	0	0	6
180	**Blunn Creek @ Riverside Drive**	**11/20/96**	0	0	0	0	0	0	0	0	0	8	0	0	2	0	0	0	0	0	0	10	0	0	0	0	0	0
363	**Blunn Creek @ Willow Run**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
853	**Boggy Creek @ Banton Road**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	36	0	0	0	0	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	0	0	0	18	2	0	0	0	0	0	124	2	0	0	4	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	0	0	0	18	0	0	0	0	0	0	110	0	0	0	2	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	1	0	0	0	3	0	0	0	0	0	149	0	0	0	2	0	0	0	0	0	0	0	0	0
784	**North Boggy Creek @ Airport Rd.**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	9
493	**North Boggy Creek @ Delwau Lane**	**11/18/96**	0	1	8	0	0	0	3	0	0	0	1	0	37	0	0	0	0	0	0	0	0	0	0	0	0	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	0	0	3	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0
920	**Bull Creek @ St. Ed's Park above dam**	**11/20/96**	0	0	0	0	0	0	0	0	4	0	0	0	16	0	0	0	0	0	0	0	0	0	2	2	0	0
347	**Bull Creek Above West Bull Creek**	**11/18/96**	0	0	10	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	2	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0
783	**Buttermilk Creek @ Cameron Road**	**11/19/96**	0	0	8	1	0	0	10	0	1	1	0	0	15	0	0	0	2	0	0	0	0	0	0	0	0	0
851	**Buttermilk @ Little Walnut Creek**	**11/20/96**	0	0	4	0	0	0	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0
782	**Buttermilk Creek @ Providence Ave**	**11/19/96**	0	0	2	0	0	0	6	0	2	0	0	0	24	0	0	0	5	0	0	0	0	0	0	0	0	0
850	**Country Club Creek @ East Oltorf St**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	FRAGILARIA FASCICULATA	FRAGILARIA PULCHELLA	FRAGILARIA ULNA	GOMPHONEMA ACUMINATUM	GOMPHONEMA ANGUSTUM	GOMPHONEMA AQUAEMINERALIS	GOMPHONEMA CLAVATUM	GOMPHONEMA DICHOTOMUM	GOMPHONEMA GRACILE	GOMPHONEMA GROVEI	GOMPHONEMA INSIGNE	GOMPHONEMA MINUTUM	GOMPHONEMA PARVULUM	GOMPHONEMA PSEUDOAUGUR	GOMPHONEMA RHOMBICUM	GOMPHONEMA SP. 1	GOMPHONEMA TRUNCATUM	GYROSIGMA ATTENUATUM	GYROSIGMA NODIFERUM	GYROSIGMA SCALPROIDES	HANTZSCHIA AMPHIOXYS	MARILIA	MASTOGLOIA SMITHII	MELOSIRA LINEATA	MELOSIRA VARIANS	NAVICULA ABSOLUTA
119	East Bouldin Creek @ Elizabeth St	11/20/96	0	0	0	0	28	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0
115	East Bouldin Creek @ Riverside Dr	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	Fort Branch Creek @ Boggy Creek	11/18/96	0	0	0	0	0	0	2	0	0	1	0	0	9	0	0	0	1	0	0	0	0	0	0	0	0	0
126	Fort Branch Creek @ Glencrest Dr	11/19/96	16	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0
125	Fort Branch Creek Above Manor Rd	11/19/96	0	0	4	0	0	0	0	0	0	0	0	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0
898	Ft. Branch @ Single Shot	11/22/96	4	0	0	0	1	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0
877	Harper's Branch @ Windoak	11/19/96	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
844	Harper's Branch @ Woodland	11/19/96	0	0	0	0	0	0	3	0	0	0	0	2	21	0	0	0	0	0	0	0	0	0	0	0	0	0
484	Harper's Branch Creek @ Riverside	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
847	Johnson @ South Tarrytown	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
847	Johnson @ South Tarrytown	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	Little Walnut @ Golden Meadow	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
839	Little Walnut Creek @ Hermitage	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	Little Walnut Creek @ US290	11/21/96	0	0	4	0	0	0	2	0	0	2	0	0	13	0	0	0	1	0	0	0	0	0	0	0	0	0
883	Onion Creek @ FM 973	11/18/96	0	0	0	0	2	0	0	0	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	4	0	0
883	Onion Creek @ FM 973	11/18/96	0	0	7	0	5	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	2	0	0
255	Onion Creek @ McKinney Falls	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	0	0	0	0	0	0	0	0	4	0	0
255	Onion Creek @ McKinney Falls	11/18/96	0	0	14	0	2	0	0	0	0	0	0	0	22	0	0	0	0	0	0	0	0	0	0	0	3	0
220	Onion Creek @ Old Lockhart Hwy	11/18/96	0	0	4	0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	0	0	0	0	2	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0
239	Onion Creek Above IH35 (OC2)	11/18/96	0	0	18	0	6	0	0	0	0	0	0	0	7	2	0	0	0	0	0	0	0	0	2	0	0	0
239	Onion Creek Above IH35 (OC2)	11/18/96	0	0	38	0	0	0	0	0	0	0	0	0	6	0	6	0	0	0	0	0	0	0	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	FRAGILARIA FASCICULATA	FRAGILARIA PULCHELLA	FRAGILARIA ULNA	GOMPHONEMA ACUMINATUM	GOMPHONEMA ANGUSTUM	GOMPHONEMA AQUAEMINERALIS	GOMPHONEMA CLAVATUM	GOMPHONEMA DICHOTOMUM	GOMPHONEMA GRACILE	GOMPHONEMA GROVEI	GOMPHONEMA INSIGNE	GOMPHONEMA MINUTUM	GOMPHONEMA PARVULUM	GOMPHONEMA PSEUDOAUGUR	GOMPHONEMA RHOMBICUM	GOMPHONEMA SP. 1	GOMPHONEMA TRUNCATUM	GYROSIGMA ATTENUATUM	GYROSIGMA NODIFERUM	GYROSIGMA SCALPROIDES	HANTZSCHIA AMPHIOXYS	MARILIA	MASTOGLOIA SMITHII	MELOSIRA LINEATA	MELOSIRA VARIANS	NAVICULA ABSOLUTA
116	**Shoal Creek @ 24th St. (EII)**	**11/19/96**	0	0	0	0	0	0	0	0	47	0	0	0	98	0	0	0	2	0	0	0	0	0	0	0	0	0
117	**Shoal Creek @ Shoal Edge Court**	**11/18/96**	0	0	6	0	0	0	0	0	0	0	0	0	18	3	0	0	0	0	0	0	0	0	0	0	0	0
122	**Shoal Creek Above 1st St.**	**11/20/96**	0	0	8	2	0	0	0	0	0	0	0	0	64	0	0	0	0	0	0	0	0	0	0	4	0	0
842	**Tannehill Creek @ Bartholomew Park**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0
854	**Tannehill Creek @ Boggy Creek**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
841	**Tannehill Creek @ Highland Mall**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0
843	**Tannehill Creek @ Lovell Drive**	**11/19/96**	0	0	0	0	0	0	5	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0
38	**Waller Creek @ Ceasar Chavez**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	5	101	0	0	0	0	0	0	0	0	0	0	0	0	0
624	**Waller Creek @ 23rd St. (USGS)**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0
780	**Waller Creek @ 51st Street**	**11/18/96**	0	0	0	0	0	6	0	0	0	0	0	0	58	0	0	0	0	0	0	0	0	0	0	0	0	0
781	**Waller Creek @ Shipe Park**	**11/18/96**	0	0	0	0	0	0	4	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0
659	**Walnut Creek @ Lamar Blvd**	**11/20/96**	0	0	1	7	0	0	0	0	0	0	0	0	14	0	0	0	11	0	0	0	0	0	0	8	0	0
465	**Walnut Creek @ Loyola**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	1	0	0	0	0	0	0	1	0	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	1	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
464	**Walnut Creek Below IH35**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	4	0	0
878	**West Bouldin Creek @ Jewell**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
223	**Williamson Creek @ McKinney Falls**	**11/22/96**	6	0	4	1	0	0	36	0	0	0	0	0	44	0	0	0	7	0	0	0	0	0	0	0	3	0
492	**Williamson @ Nuckols Crossing**	**11/21/96**	4	0	3	0	0	0	0	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
			30	1	263	13	60	42	95	6	63	23	1	19	1807	11	6	6	41	2	1	12	8	7	29	51	6	103

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NAVICULA ACCOMODA	NAVICULA ANGUSTA	NAVICULA ARVENSIS	NAVICULA ATOMUS	NAVICULA BACILLOIDES	NAVICULA CINCTA	NAVICULA CONFERVACEA	NAVICULA CRYPTOCEPHALA	NAVICULA CRYPTOTENELLA	NAVICULA CUSPIDATA	NAVICULA DECUSSIS	NAVICULA ELGINENSIS	NAVICULA ERIFUGA	NAVICULA GASTRUM	NAVICULA GOEPPERTIANA	NAVICULA HALOPHILA	NAVICULA INCERTATA	NAVICULA INGENUA	NAVICULA KRIEGERII	NAVICULA LANCEOLATA	NAVICULA LIBONENSIS	NAVICULA LONGICEPHALA	NAVICULA MENISCULUS
48	Barton @ 71 Below Little Barton	11/21/96	0	0	0	0	0	11	0	1	11	0	0	0	0	0	0	0	0	0	0	0	2	0	0
88	Barton Creek @ Lost Creek Bridge	11/20/96	0	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
82	Barton Below Barton Creek Blvd	11/20/96	0	0	0	0	0	0	0	3	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
362	Blunn Creek - Preserve	11/19/96	0	0	0	0	0	0	0	6	10	0	0	0	6	0	6	0	0	0	0	0	0	0	0
180	Blunn Creek @ Riverside Drive	11/20/96	0	0	0	0	0	8	0	4	0	0	0	0	2	0	0	0	0	38	0	0	0	0	0
363	Blunn Creek @ Willow Run	11/19/96	0	0	2	0	0	0	0	6	32	0	0	0	10	0	2	0	0	2	0	0	0	0	0
364	Blunn Creek Above Stacy Pool	11/20/96	0	0	0	1	0	5	0	0	297	0	0	0	45	0	2	0	0	0	0	0	0	0	0
364	Blunn Creek Above Stacy Pool	11/20/96	0	0	0	2	0	14	2	0	164	0	0	0	89	0	4	0	0	2	0	0	0	0	0
364	Blunn Creek Above Stacy Pool	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
853	Boggy Creek @ Banton Road	11/19/96	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	16	0	0	0	0	2
837	Boggy Creek @ Nile Road	11/18/96	0	0	0	6	0	0	2	0	6	0	0	0	6	0	0	0	0	0	0	0	0	0	0
837	Boggy Creek @ Nile Road	11/18/96	0	0	0	30	0	0	2	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0
837	Boggy Creek @ Nile Road	11/18/96	0	0	1	4	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
784	North Boggy Creek @ Airport Rd.	11/19/96	0	0	0	0	0	0	2	0	0	0	0	0	0	0	21	0	0	58	0	0	0	0	0
493	North Boggy Creek @ Delwau Lane	11/18/96	0	0	0	0	0	0	4	2	0	0	0	0	12	0	0	0	0	0	0	0	0	0	1
350	Bull Creek @ 360 First Crossing	11/18/96	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
350	Bull Creek @ 360 First Crossing	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
920	Bull Creek @ St. Ed's Park above dam	11/20/96	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12
347	Bull Creek Above West Bull Creek	11/18/96	0	0	0	0	0	0	0	0	10	0	0	0	2	0	0	0	0	0	0	0	0	0	0
151	Tributary 6 @ Bull Creek (EG)	11/19/96	0	0	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
151	Tributary 6 @ Bull Creek (EG)	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
783	Buttermilk Creek @ Cameron Road	11/19/96	0	0	0	0	0	0	0	4	2	0	0	0	10	0	2	0	0	0	0	0	0	0	3
851	Buttermilk @ Little Walnut Creek	11/20/96	0	0	0	0	0	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
782	Buttermilk Creek @ Providence Ave	11/19/96	0	0	1	0	0	0	1	4	2	0	0	0	5	2	5	0	0	1	0	0	0	0	2
850	Country Club Creek @ East Oltorf St	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NAVICULA ACCOMODA	NAVICULA ANGUSTA	NAVICULA ARVENSIS	NAVICULA ATOMUS	NAVICULA BACILLOIDES	NAVICULA CINCTA	NAVICULA CONFERVACEA	NAVICULA CRYPTOCEPHALA	NAVICULA CRYPTOTENELLA	NAVICULA CUSPIDATA	NAVICULA DECUSSIS	NAVICULA ELGINENSIS	NAVICULA ERIFUGA	NAVICULA GASTRUM	NAVICULA GOEPPERTIANA	NAVICULA HALOPHILA	NAVICULA INCERTATA	NAVICULA INGENUA	NAVICULA KRIEGERII	NAVICULA LANCEOLATA	NAVICULA LIBONENSIS	NAVICULA LONGICEPHALA	NAVICULA MENISCULUS
119	**East Bouldin Creek @ Elizabeth St**	**11/20/96**	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	5	0	0	0	0	0
115	**East Bouldin Creek @ Riverside Dr**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	43	0	0	0	0	0
123	**Fort Branch Creek @ Boggy Creek**	**11/18/96**	0	0	0	0	0	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	1
126	**Fort Branch Creek @ Glencrest Dr**	**11/19/96**	0	0	0	0	0	0	16	14	0	0	0	0	5	0	15	0	0	2	0	0	0	0	4
125	**Fort Branch Creek Above Manor Rd**	**11/19/96**	0	0	0	0	0	0	0	4	0	0	0	0	12	0	0	0	0	0	0	0	0	0	4
898	**Ft. Branch @ Single Shot**	**11/22/96**	0	0	2	5	0	3	0	0	0	0	0	0	8	0	0	0	0	0	0	0	2	0	2
877	**Harper's Branch @ Windoak**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	1	0	0	0	0	0
844	**Harper's Branch @ Woodland**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
484	**Harper's Branch Creek @ Riverside**	**11/19/96**	0	0	2	0	0	0	0	0	0	0	0	0	24	0	9	0	0	52	0	0	0	0	0
847	**Johnson @ South Tarrytown**	**11/20/96**	0	0	2	0	0	0	0	4	2	4	0	0	46	0	0	0	34	0	0	0	0	0	0
847	**Johnson @ South Tarrytown**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	**Little Walnut @ Golden Meadow**	**11/20/96**	0	0	0	0	0	0	10	6	22	0	0	0	82	0	0	0	0	0	0	0	0	0	2
839	**Little Walnut Creek @ Hermitage**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
634	**Little Walnut Creek @ US183**	**11/21/96**	0	0	0	0	0	0	0	4	4	0	0	0	2	0	0	0	0	0	0	0	0	0	2
634	**Little Walnut Creek @ US183**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	**Little Walnut Creek @ US290**	**11/21/96**	0	0	0	0	0	0	0	0	13	0	0	0	4	0	0	0	0	0	0	0	0	0	4
883	**Onion Creek @ FM 973**	**11/18/96**	0	0	2	0	0	18	0	17	4	0	0	0	35	0	0	0	0	0	0	45	4	0	3
883	**Onion Creek @ FM 973**	**11/18/96**	0	0	1	0	0	1	0	32	0	0	0	0	14	0	0	0	0	0	0	47	0	0	3
255	**Onion Creek @ McKinney Falls**	**11/18/96**	0	0	0	0	0	0	2	18	22	0	0	0	2	0	0	0	0	0	0	0	0	0	0
255	**Onion Creek @ McKinney Falls**	**11/18/96**	0	0	0	0	0	0	0	10	0	0	3	0	0	0	2	0	0	0	0	0	0	0	2
220	**Onion Creek @ Old Lockhart Hwy**	**11/18/96**	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
236	**Onion Creek @ Twin Creek Bridge**	**11/18/96**	0	0	0	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
236	**Onion Creek @ Twin Creek Bridge**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
239	**Onion Creek Above IH35 (OC2)**	**11/18/96**	0	0	0	0	0	0	0	10	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
239	**Onion Creek Above IH35 (OC2)**	**11/18/96**	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NAVICULA ACCOMODA	NAVICULA ANGUSTA	NAVICULA ARVENSIS	NAVICULA ATOMUS	NAVICULA BACILLOIDES	NAVICULA CINCTA	NAVICULA CONFERVACEA	NAVICULA CRYPTOCEPHALA	NAVICULA CRYPTOTENELLA	NAVICULA CUSPIDATA	NAVICULA DECUSSIS	NAVICULA ELGINENSIS	NAVICULA ERIFUGA	NAVICULA GASTRUM	NAVICULA GOEPPERTIANA	NAVICULA HALOPHILA	NAVICULA INCERTATA	NAVICULA INGENUA	NAVICULA KRIEGERII	NAVICULA LANCEOLATA	NAVICULA LIBONENSIS	NAVICULA LONGICEPHALA	NAVICULA MENISCULUS
116	**Shoal Creek @ 24th St. (EII)**	**11/19/96**	0	0	0	0	0	0	0	4	3	0	0	0	5	0	0	0	0	0	0	0	0	0	2
117	**Shoal Creek @ Shoal Edge Court**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0
122	**Shoal Creek Above 1st St.**	**11/20/96**	0	0	0	0	0	0	2	0	6	0	0	0	30	0	0	0	0	0	0	0	0	0	0
842	**Tannehill Creek @ Bartholomew Park**	**11/19/96**	0	0	0	0	0	0	8	4	2	0	0	0	66	0	2	0	0	0	0	0	0	0	2
854	**Tannehill Creek @ Boggy Creek**	**11/18/96**	0	2	0	0	0	0	0	0	0	0	0	0	28	0	0	0	0	0	0	0	0	0	0
841	**Tannehill Creek @ Highland Mall**	**11/19/96**	0	0	2	0	0	0	31	0	0	2	0	0	0	0	8	0	0	0	0	0	0	0	10
843	**Tannehill Creek @ Lovell Drive**	**11/19/96**	0	0	2	18	0	0	0	2	0	0	0	0	3	0	0	0	0	2	0	0	0	0	0
38	**Waller Creek @ Ceasar Chavez**	**11/18/96**	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	5
624	**Waller Creek @ 23rd St. (USGS)**	**11/19/96**	0	0	2	0	0	0	6	0	6	0	0	0	4	0	0	0	0	0	0	0	0	0	0
780	**Waller Creek @ 51st Street**	**11/18/96**	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
781	**Waller Creek @ Shipe Park**	**11/18/96**	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0	0	0	9	0	0	0	0	2
659	**Walnut Creek @ Lamar Blvd**	**11/20/96**	0	0	0	0	0	26	2	6	0	0	0	0	21	0	0	0	0	0	0	0	0	0	7
465	**Walnut Creek @ Loyola**	**11/21/96**	0	0	0	0	0	0	0	4	0	0	0	0	26	0	0	0	0	0	0	0	0	0	6
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	7	0	0	2	0	0	0	5	0	1	0	0	0	0	1	0	0	0	0	2
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	72	0	0	0	4	8	0	0	0	2	0	0	0	0	0	0	0	0	0	20
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	41	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
464	**Walnut Creek Below IH35**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0	0	0	0	0	0	0	0	6
878	**West Bouldin Creek @ Jewell**	**11/20/96**	0	0	0	0	0	13	2	6	0	0	0	0	0	0	0	0	0	14	0	0	0	0	2
223	**Williamson Creek @ McKinney Falls**	**11/22/96**	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
492	**Williamson @ Nuckols Crossing**	**11/21/96**	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
			4	40	55	348	8	185	106	379	896	6	20	4	764	2	97	10	34	432	77.5	116	8	2	181.5

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(Counts)

Site #	Sample Site Name	Date	NAVICULA MINIMA	NAVICULA MINUSCULA	NAVICULA MONOCULATA	NAVICULA MUTICA	NAVICULA PSEUDANGLICA	NAVICULA PSEUDOLANCEOLATA	NAVICULA PUPULA	NAVICULA PYGMAEA	NAVICULA RADIOSA	NAVICULA RADIOSA V. TENELLA	NAVICULA RECENS	NAVICULA REICHARDTIANA	NAVICULA RHYNCHOCEPHALA	NAVICULA SANCTAECRUCIS	NAVICULA SCHROETERII	NAVICULA SEMINULUM	NAVICULA SP. 3	NAVICULA SP. 4	NAVICULA SP. 5	NAVICULA SP.1	NAVICULA SP.2	NAVICULA STROEMII	NAVICULA SUBMINISCULA	NAVICULA SUBTILISSIMA
48	**Barton @ 71 Below Little Barton**	**11/21/96**	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	**Barton Creek @ Lost Creek Bridge**	**11/20/96**	0	0	2	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	10	0	0
82	**Barton Below Barton Creek Blvd**	**11/20/96**	2	0	0	0	0	8	3	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
362	**Blunn Creek - Preserve**	**11/19/96**	88	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
180	**Blunn Creek @ Riverside Drive**	**11/20/96**	124	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
363	**Blunn Creek @ Willow Run**	**11/19/96**	168	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	0
853	**Boggy Creek @ Banton Road**	**11/19/96**	166	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	92	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	32	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	44	0	0	1	0	0	10	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	18	0
784	**North Boggy Creek @ Airport Rd.**	**11/19/96**	101	0	4	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
493	**North Boggy Creek @ Delwau Lane**	**11/18/96**	3	0	0	0	0	0	8	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	1	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
920	**Bull Creek @ St. Ed's Park above dam**	**11/20/96**	0	0	0	0	0	0	10	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
347	**Bull Creek Above West Bull Creek**	**11/18/96**	3	0	0	0	0	0	6	0	0	0	0	0	0	0	6	0	0	0	0	0	0	24	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
783	**Buttermilk Creek @ Cameron Road**	**11/19/96**	85	0	1	0	0	0	5	0	0	0	0	0	0	0	45	0	0	0	0	0	0	3	0	0
851	**Buttermilk @ Little Walnut Creek**	**11/20/96**	0	0	2	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0
782	**Buttermilk Creek @ Providence Ave**	**11/19/96**	85	0	5	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
850	**Country Club Creek @ East Oltorf St**	**11/19/96**	89	0	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NAVICULA MINIMA	NAVICULA MINUSCULA	NAVICULA MONOCULATA	NAVICULA MUTICA	NAVICULA PSEUDANGLICA	NAVICULA PSEUDOLANCEOLATA	NAVICULA PUPULA	NAVICULA PYGMAEA	NAVICULA RADIOSA	NAVICULA RADIOSA V. TENELLA	NAVICULA RECENS	NAVICULA REICHARDTIANA	NAVICULA RHYNCHOCEPHALA	NAVICULA SANCTAECRUCIS	NAVICULA SCHROETERII	NAVICULA SEMINULUM	NAVICULA SP. 3	NAVICULA SP. 4	NAVICULA SP. 5	NAVICULA SP.1	NAVICULA SP.2	NAVICULA STROEMII	NAVICULA SUBMINISCULA	NAVICULA SUBTILISSIMA
119	East Bouldin Creek @ Elizabeth St	11/20/96	185	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
115	East Bouldin Creek @ Riverside Dr	11/20/96	314	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
123	Fort Branch Creek @ Boggy Creek	11/18/96	4	0	1	0	0	0	3	0	0	0	4	0	0	0	1	0	0	0	0	0	0	3	1	0
126	Fort Branch Creek @ Glencrest Dr	11/19/96	115	0	10	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
125	Fort Branch Creek Above Manor Rd	11/19/96	103	2	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
898	Ft. Branch @ Single Shot	11/22/96	8	0	11	1	0	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
877	Harper's Branch @ Windoak	11/19/96	0	0	2	0	0	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
844	Harper's Branch @ Woodland	11/19/96	15	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
484	Harper's Branch Creek @ Riverside	11/19/96	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
847	Johnson @ South Tarrytown	11/20/96	8	0	16	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0
847	Johnson @ South Tarrytown	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	Little Walnut @ Golden Meadow	11/20/96	0	0	22	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
839	Little Walnut Creek @ Hermitage	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	Little Walnut Creek @ US290	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	12	0	0
883	Onion Creek @ FM 973	11/18/96	0	0	0	0	0	0	2	0	0	0	9	0	0	0	3	0	0	0	0	0	0	0	0	0
883	Onion Creek @ FM 973	11/18/96	0	0	0	1	0	0	2	0	0	0	33	0	0	0	2	0	0	0	0	0	0	0	3	0
255	Onion Creek @ McKinney Falls	11/18/96	0	0	0	0	0	0	2	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
255	Onion Creek @ McKinney Falls	11/18/96	2	0	0	0	0	0	0	0	34	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0
220	Onion Creek @ Old Lockhart Hwy	11/18/96	0	0	0	0	0	0	1	0	92	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	120	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	220	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	110	0
239	Onion Creek Above IH35 (OC2)	11/18/96	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
239	Onion Creek Above IH35 (OC2)	11/18/96	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	4	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NAVICULA MINIMA	NAVICULA MINUSCULA	NAVICULA MONOCULATA	NAVICULA MUTICA	NAVICULA PSEUDANGLICA	NAVICULA PSEUDOLANCEOLATA	NAVICULA PUPULA	NAVICULA PYGMAEA	NAVICULA RADIOSA	NAVICULA RADIOSA V. TENELLA	NAVICULA RECENS	NAVICULA REICHARDTIANA	NAVICULA RHYNCHOCEPHALA	NAVICULA SANCTAECRUCIS	NAVICULA SCHROETERII	NAVICULA SEMINULUM	NAVICULA SP. 3	NAVICULA SP. 4	NAVICULA SP. 5	NAVICULA SP.1	NAVICULA SP.2	NAVICULA STROEMII	NAVICULA SUBMINISCULA	NAVICULA SUBTILISSIMA
116	Shoal Creek @ 24th St. (EII)	11/19/96	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
117	Shoal Creek @ Shoal Edge Court	11/18/96	152	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0
122	Shoal Creek Above 1st St.	11/20/96	19	2	0	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
842	Tannehill Creek @ Bartholomew Park	11/19/96	64	0	11	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
854	Tannehill Creek @ Boggy Creek	11/18/96	43	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	6	0
841	Tannehill Creek @ Highland Mall	11/19/96	111	0	110	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
843	Tannehill Creek @ Lovell Drive	11/19/96	87	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	0
38	Waller Creek @ Ceasar Chavez	11/18/96	163	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0
624	Waller Creek @ 23rd St. (USGS)	11/19/96	296	0	40	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
780	Waller Creek @ 51st Street	11/18/96	194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
781	Waller Creek @ Shipe Park	11/18/96	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
659	Walnut Creek @ Lamar Blvd	11/20/96	2	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	11	0
465	Walnut Creek @ Loyola	11/21/96	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	0
503	Walnut Creek @ Railroad Bridge	11/21/96	36	8	0	0	0	0	0	0	0	0	13	0	0	0	1	0	0	0	0	0	0	5	8	0
503	Walnut Creek @ Railroad Bridge	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	Walnut Creek @ Springdale Rd	11/20/96	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22	0
500	Walnut Creek @ Springdale Rd	11/20/96	50	0	0	0	0	0	2	0	0	2	5	0	0	0	0	0	0	0	0	0	0	0	41	0
500	Walnut Creek @ Springdale Rd	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
464	Walnut Creek Below IH35	11/20/96	35	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	16	0
878	West Bouldin Creek @ Jewell	11/20/96	213	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0
223	Williamson Creek @ McKinney Falls	11/22/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
492	Williamson @ Nuckols Crossing	11/21/96	6	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	1	0
			4102	412	472	7	2	8	197	20	197	13	85	4	7	6	127	2	8	10	14	12	4	89	622	4

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NAVICULA SYMMETRICA	NAVICULA TENELLOIDES	NAVICULA TEXANA	NAVICULA TRIDENTULA	NAVICULA TRIPUNCTATA V. SCHIZONEMOIDES	NAVICULA TRIVIALIS	NAVICULA VENETA	NAVICULA VIRIDULA	NAVICULA VIRIDULA V. ROSTELLATA	NEIDIUM AMPLIATUM	NEOCHOROTERPES	NITZSCHIA ACICULARIS	NITZSCHIA AGNITA	NITZSCHIA AMPHIBIA	NITZSCHIA AMPHIBIOIDES	NITZSCHIA CLAUSII	NITZSCHIA CONSTRICTA	NITZSCHIA DISSIPATA	NITZSCHIA FILIFORMIS	NITZSCHIA FONTICOLA
48	**Barton @ 71 Below Little Barton**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
88	**Barton Creek @ Lost Creek Bridge**	**11/20/96**	0	0	3	0	0	0	3	0	0	0	0	0	0	28	0	0	0	0	0	0
82	**Barton Below Barton Creek Blvd**	**11/20/96**	0	0	2	0	0	0	3	0	0	0	0	2	0	44	0	0	2	0	3	0
362	**Blunn Creek - Preserve**	**11/19/96**	0	0	2	0	0	0	0	4	0	0	0	0	0	8	0	4	8	2	0	0
180	**Blunn Creek @ Riverside Drive**	**11/20/96**	0	0	2	0	0	0	2	4	0	0	0	0	0	0	0	2	2	8	0	0
363	**Blunn Creek @ Willow Run**	**11/19/96**	0	0	54	0	0	0	0	0	0	0	0	0	0	2	0	20	0	0	0	0
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	3	0	0	0	2
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	0	0	0	0	0	0	2	2	0	0	0	0	0	2	0	12	6	0	0	4
364	**Blunn Creek Above Stacy Pool**	**11/20/96**	110	181	2	0	0	0	0	0	0	0	0	0	0	0	14	5	0	0	0	0
853	**Boggy Creek @ Banton Road**	**11/19/96**	0	0	2	0	0	0	0	0	0	0	0	0	0	34	0	8	2	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	12	0	0	0	6	0	0	0	0	0	0	46	0	4	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	0	2	0	0	0	12	0	0	0	0	0	0	40	0	6	0	0	0	0
837	**Boggy Creek @ Nile Road**	**11/18/96**	0	1	8	0	0	0	0	0	0	0	0	0	0	80	0	3	0	0	0	0
784	**North Boggy Creek @ Airport Rd.**	**11/19/96**	0	0	12	0	0	0	0	2	0	0	0	0	0	165	0	0	0	0	0	0
493	**North Boggy Creek @ Delwau Lane**	**11/18/96**	49	4	1	0	0	6	0	19	0	0	0	0	0	24	0	3	1	2	2	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	0	0	4	0	0	0	2	0	0	0	0	0	0	12	0	0	0	0	1	0
350	**Bull Creek @ 360 First Crossing**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	1	0	0	0
920	**Bull Creek @ St. Ed's Park above dam**	**11/20/96**	0	0	2	2	0	0	10	0	0	0	0	0	0	34	0	0	0	0	0	0
347	**Bull Creek Above West Bull Creek**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	2	0	0	0	8	0	0	0	0	0	0	2	0	0	2	0	0	0
151	**Tributary 6 @ Bull Creek (EG)**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
783	**Buttermilk Creek @ Cameron Road**	**11/19/96**	0	0	13	0	0	0	11	7	0	0	0	0	0	11	0	53	2	1	0	0
851	**Buttermilk @ Little Walnut Creek**	**11/20/96**	0	0	12	0	0	0	8	0	0	0	0	0	0	4	0	12	2	0	0	0
782	**Buttermilk Creek @ Providence Ave**	**11/19/96**	14	3	2	0	0	16	3	2	0	0	0	0	0	72	0	89	2	1	9	0
850	**Country Club Creek @ East Oltorf St**	**11/19/96**	1	2	0	0	0	0	2	0	0	0	0	0	0	26	0	8	2	1	1	0

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(Counts)

Site #	Sample Site Name	Date	NAVICULA SYMMETRICA	NAVICULA TENELLOIDES	NAVICULA TEXANA	NAVICULA TRIDENTULA	NAVICULA TRIPUNCTATA V. SCHIZONEMOIDES	NAVICULA TRIVIALIS	NAVICULA VENETA	NAVICULA VIRIDULA	NAVICULA VIRIDULA V. ROSTELLATA	NEIDIUM AMPLIATUM	NEOCHOROTERPES	NITZSCHIA ACICULARIS	NITZSCHIA AGNITA	NITZSCHIA AMPHIBIA	NITZSCHIA AMPHIBIOIDES	NITZSCHIA CLAUSII	NITZSCHIA CONSTRICTA	NITZSCHIA DISSIPATA	NITZSCHIA FILIFORMIS	NITZSCHIA FONTICOLA
119	East Bouldin Creek @ Elizabeth St	11/20/96	0	0	0	0	0	2	2	0	0	0	0	0	0	71	0	12	0	0	0	0
115	East Bouldin Creek @ Riverside Dr	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0
123	Fort Branch Creek @ Boggy Creek	11/18/96	3	1	1	0	0	0	14	2	0	0	0	0	0	2	0	19	1	0	0	0
126	Fort Branch Creek @ Glencrest Dr	11/19/96	0	0	4	0	0	0	0	11	0	0	0	0	0	206	0	4	5	0	0	0
125	Fort Branch Creek Above Manor Rd	11/19/96	0	0	0	0	0	0	9	2	0	0	0	0	0	161	0	16	4	0	0	0
898	Ft. Branch @ Single Shot	11/22/96	0	2	0	0	0	0	11	4	0	0	0	0	0	1	0	67	0	0	3	0
877	Harper's Branch @ Windoak	11/19/96	0	0	0	0	0	0	0	2	0	0	0	0	0	11	0	0	0	0	0	0
844	Harper's Branch @ Woodland	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	351	0	0	0	0	0	0
484	Harper's Branch Creek @ Riverside	11/19/96	12	13	3	0	0	1	0	16	0	2	0	0	0	57	0	30	10	2	0	0
847	Johnson @ South Tarrytown	11/20/96	0	0	20	0	0	0	6	8	0	0	0	0	0	48	0	8	2	0	0	0
847	Johnson @ South Tarrytown	11/20/96	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
838	Little Walnut @ Golden Meadow	11/20/96	0	0	10	0	0	10	0	24	0	0	0	0	0	54	2	36	4	0	14	0
839	Little Walnut Creek @ Hermitage	11/20/96	0	0	0	0	0	4	0	0	0	0	0	0	0	22	0	2	0	0	0	0
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	2	0	4	0	0	0	0	0	0	0	0	0	0	2	0
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0
840	Little Walnut Creek @ US290	11/21/96	27	0	3	0	0	9	5	6	0	0	0	0	0	47	0	3	4	0	0	0
883	Onion Creek @ FM 973	11/18/96	0	5	1	0	0	0	6	32	0	0	0	2	0	12	0	0	8	0	2	1
883	Onion Creek @ FM 973	11/18/96	0	1	0	0	0	0	10	17	0	0	0	1	0	7	0	0	16	0	0	0
255	Onion Creek @ McKinney Falls	11/18/96	0	0	0	0	0	0	4	17	0	0	0	0	0	16	0	2	8	2	0	0
255	Onion Creek @ McKinney Falls	11/18/96	4	2	7	0	12	0	0	0	1	0	0	0	0	8	0	0	7	0	0	0
220	Onion Creek @ Old Lockhart Hwy	11/18/96	1	0	0	0	0	0	3	0	0	0	0	0	0	9	0	0	0	0	0	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	0	0	4	0	0	0	5	0	0	0	0	0	0	13	0	0	0	0	0	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	2	0	0	0	0
239	Onion Creek Above IH35 (OC2)	11/18/96	0	0	2	0	0	0	7	2	0	0	0	0	0	36	0	0	0	0	0	0
239	Onion Creek Above IH35 (OC2)	11/18/96	0	0	3	0	0	0	0	0	0	0	0	0	0	16	11	0	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NAVICULA SYMMETRICA	NAVICULA TENELLOIDES	NAVICULA TEXANA	NAVICULA TRIDENTULA	NAVICULA TRIPUNCTATA V. SCHIZONEMOIDES	NAVICULA TRIVIALIS	NAVICULA VENETA	NAVICULA VIRIDULA	NAVICULA VIRIDULA V. ROSTELLATA	NEIDIUM AMPLIATUM	NEOCHOROTERPES	NITZSCHIA ACICULARIS	NITZSCHIA AGNITA	NITZSCHIA AMPHIBIA	NITZSCHIA AMPHIBIOIDES	NITZSCHIA CLAUSII	NITZSCHIA CONSTRICTA	NITZSCHIA DISSIPATA	NITZSCHIA FILIFORMIS	NITZSCHIA FONTICOLA
116	**Shoal Creek @ 24th St. (EII)**	**11/19/96**	0	0	0	0	0	0	4	3	0	0	0	0	0	32	0	3	7	0	0	0
117	**Shoal Creek @ Shoal Edge Court**	**11/18/96**	0	0	0	0	0	0	5	2	0	0	0	0	0	12	0	2	2	0	0	0
122	**Shoal Creek Above 1st St.**	**11/20/96**	0	0	0	0	0	0	22	32	0	0	0	0	0	2	0	0	0	0	2	0
842	**Tannehill Creek @ Bartholomew Park**	**11/19/96**	0	0	2	0	0	0	8	8	0	0	0	0	0	96	0	38	5	0	20	0
854	**Tannehill Creek @ Boggy Creek**	**11/18/96**	0	12	0	0	0	0	2	1	0	0	0	0	0	18	0	22	0	0	0	0
841	**Tannehill Creek @ Highland Mall**	**11/19/96**	0	0	0	0	0	0	4	0	0	0	0	0	0	105	0	0	0	0	0	0
843	**Tannehill Creek @ Lovell Drive**	**11/19/96**	7	6	0	0	0	2	7	5	0	0	0	0	0	14	0	6	0	0	0	0
38	**Waller Creek @ Ceasar Chavez**	**11/18/96**	0	0	0	0	0	0	2	4	0	0	0	0	0	36	0	0	0	0	0	0
624	**Waller Creek @ 23rd St. (USGS)**	**11/19/96**	0	0	2	0	0	0	4	0	0	0	0	0	0	0	0	0	2	0	0	0
780	**Waller Creek @ 51st Street**	**11/18/96**	0	0	0	0	0	0	2	0	0	0	0	0	0	128	0	8	0	0	0	0
781	**Waller Creek @ Shipe Park**	**11/18/96**	0	4	0	0	0	0	0	0	0	0	0	0	0	206	0	0	0	0	0	0
659	**Walnut Creek @ Lamar Blvd**	**11/20/96**	0	0	2	0	0	0	10	8	0	0	0	0	0	16	0	1	16	3	6	0
465	**Walnut Creek @ Loyola**	**11/21/96**	0	0	0	0	0	0	10	8	0	0	0	0	0	10	0	0	0	2	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	25	1	11	0	0	1	0	7	0	0	0	0	0	32	0	6	5	1	0	2
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	20	2	0	0	0	0	0	0	0	0	2	2	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	73	0	0	0	0	0	0	0	0	0
464	**Walnut Creek Below IH35**	**11/20/96**	0	0	1	0	0	0	2	2	0	0	0	0	0	11	0	2	1	0	0	0
878	**West Bouldin Creek @ Jewell**	**11/20/96**	0	0	13	0	0	0	2	4	0	0	0	0	0	23	0	14	4	0	0	0
223	**Williamson Creek @ McKinney Falls**	**11/22/96**	0	0	0	0	0	0	11	4	0	0	0	0	0	25	0	0	3	0	2	0
492	**Williamson @ Nuckols Crossing**	**11/21/96**	0	2	0	0	0	0	2	0	0	0	0	0	0	23	0	0	1	0	1	0
			257	240	242	10	12	53	289	466	1	4	94	15	22	3548.5	135	1002	189	93	160	13

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NITZSCHIA FRUSTULUM	NITZSCHIA GRACILIFORMIS	NITZSCHIA INCONSPICUA	NITZSCHIA LACUNARUM	NITZSCHIA LEVIDENSIS	NITZSCHIA LIBERTRUTHII	NITZSCHIA LINEARIS	NITZSCHIA MICROCEPHALA	NITZSCHIA NANA	NITZSCHIA PALEA	NITZSCHIA PALEACEA	NITZSCHIA PELLUCIDA	NITZSCHIA PUMILA	NITZSCHIA RECTA	NITZSCHIA REVERSA	NITZSCHIA SCALPELLIFORMIS	NITZSCHIA SOLITA	NITZSCHIA SP. 2	NITZSCHIA VERMICULARIS	PARAPOYNX	PINNULARIA ACROSPHAERIA	PINNULARIA BOREALIS	PINNULARIA BRAUNII	PINNULARIA GIBBA	PINNULARIA LUNDII
48	Barton @ 71 Below Little Barton	11/21/96	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
88	Barton Creek @ Lost Creek Bridge	11/20/96	2	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
82	Barton Below Barton Creek Blvd	11/20/96	6	0	0	0	0	0	1	0	0	8	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0
362	Blunn Creek - Preserve	11/19/96	94	0	0	0	2	0	0	2	0	22	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
180	Blunn Creek @ Riverside Drive	11/20/96	32	0	4	0	27	0	0	2	0	10	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
363	Blunn Creek @ Willow Run	11/19/96	2	0	0	0	0	0	2	0	0	32	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0
364	Blunn Creek Above Stacy Pool	11/20/96	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
364	Blunn Creek Above Stacy Pool	11/20/96	4	0	0	0	2	0	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
364	Blunn Creek Above Stacy Pool	11/20/96	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
853	Boggy Creek @ Banton Road	11/19/96	8	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
837	Boggy Creek @ Nile Road	11/18/96	46	0	0	0	0	0	2	0	0	18	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0
837	Boggy Creek @ Nile Road	11/18/96	156	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0
837	Boggy Creek @ Nile Road	11/18/96	30	0	70	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
784	North Boggy Creek @ Airport Rd.	11/19/96	14	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
493	North Boggy Creek @ Delwau Lane	11/18/96	22	0	0	0	0	0	3	1	0	35	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
350	Bull Creek @ 360 First Crossing	11/18/96	3	0	0	0	0	0	1	8	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
350	Bull Creek @ 360 First Crossing	11/18/96	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
920	Bull Creek @ St. Ed's Park above dam	11/20/96	4	0	0	0	0	0	2	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
347	Bull Creek Above West Bull Creek	11/18/96	2	0	0	0	0	0	2	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
151	Tributary 6 @ Bull Creek (EG)	11/19/96	13	0	0	0	0	0	0	8	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
151	Tributary 6 @ Bull Creek (EG)	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
783	Buttermilk Creek @ Cameron Road	11/19/96	3	0	0	0	3	0	1	3	0	21	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0
851	Buttermilk @ Little Walnut Creek	11/20/96	0	0	0	0	0	0	0	7	0	27	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
782	Buttermilk Creek @ Providence Ave	11/19/96	5	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
850	Country Club Creek @ East Oltorf St	11/19/96	124	0	24	0	0	0	1	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NITZSCHIA FRUSTULUM	NITZSCHIA GRACILIFORMIS	NITZSCHIA INCONSPICUA	NITZSCHIA LACUNARUM	NITZSCHIA LEVIDENSIS	NITZSCHIA LIBERTRUTHII	NITZSCHIA LINEARIS	NITZSCHIA MICROCEPHALA	NITZSCHIA NANA	NITZSCHIA PALEA	NITZSCHIA PALEACEA	NITZSCHIA PELLUCIDA	NITZSCHIA PUMILA	NITZSCHIA RECTA	NITZSCHIA REVERSA	NITZSCHIA SCALPELLIFORMIS	NITZSCHIA SOLITA	NITZSCHIA SP. 2	NITZSCHIA VERMICULARIS	PARAPOYNX	PINNULARIA ACROSPHAERIA	PINNULARIA BOREALIS	PINNULARIA BRAUNII	PINNULARIA GIBBA	PINNULARIA LUNDII
119	East Bouldin Creek @ Elizabeth St	11/20/96	6	0	2	0	0	0	0	0	0	8	0	0	0	0	0	0	2	0	0	0	0	0	2	0	0
115	East Bouldin Creek @ Riverside Dr	11/20/96	0	0	0	0	2	0	0	0	0	19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
123	Fort Branch Creek @ Boggy Creek	11/18/96	3	0	1	0	0	0	0	2	0	10	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
126	Fort Branch Creek @ Glencrest Dr	11/19/96	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
125	Fort Branch Creek Above Manor Rd	11/19/96	26	0	5	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
898	Ft. Branch @ Single Shot	11/22/96	45	0	2	0	0	0	0	2	0	193	0	0	0	0	4	0	16	0	0	0	0	0	0	0	0
877	Harper's Branch @ Windoak	11/19/96	20	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
844	Harper's Branch @ Woodland	11/19/96	8	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
484	Harper's Branch Creek @ Riverside	11/19/96	0	0	0	0	5	0	16	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
847	Johnson @ South Tarrytown	11/20/96	18	0	0	0	2	0	2	2	0	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
847	Johnson @ South Tarrytown	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
838	Little Walnut @ Golden Meadow	11/20/96	8	0	0	0	0	0	6	0	0	66	0	0	0	0	0	0	2	0	0	0	0	0	0	0	2
839	Little Walnut Creek @ Hermitage	11/20/96	0	0	0	0	0	0	0	4	0	20	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
634	Little Walnut Creek @ US183	11/21/96	2	0	0	0	0	0	0	2	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
840	Little Walnut Creek @ US290	11/21/96	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0
883	Onion Creek @ FM 973	11/18/96	22	0	16	0	2	0	1	1	0	20	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0
883	Onion Creek @ FM 973	11/18/96	27	0	5	0	0	0	4	2	0	44	0	0	0	0	2	0	3	0	0	0	0	0	0	0	0
255	Onion Creek @ McKinney Falls	11/18/96	23	0	5	0	0	0	6	26	0	13	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0
255	Onion Creek @ McKinney Falls	11/18/96	0	0	14	0	0	0	1	4	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
220	Onion Creek @ Old Lockhart Hwy	11/18/96	2	0	0	0	0	0	1	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	53	0	2	0	0	0	0	0	0	8	0	0	0	0	0	0	4	0	0	0	2	0	0	2	0
236	Onion Creek @ Twin Creek Bridge	11/18/96	0	0	60	0	0	0	0	0	0	6	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
239	Onion Creek Above IH35 (OC2)	11/18/96	8	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
239	Onion Creek Above IH35 (OC2)	11/18/96	0	0	0	2	0	0	1	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	NITZSCHIA FRUSTULUM	NITZSCHIA GRACILIFORMIS	NITZSCHIA INCONSPICUA	NITZSCHIA LACUNARUM	NITZSCHIA LEVIDENSIS	NITZSCHIA LIBERTRUTHII	NITZSCHIA LINEARIS	NITZSCHIA MICROCEPHALA	NITZSCHIA NANA	NITZSCHIA PALEA	NITZSCHIA PALEACEA	NITZSCHIA PELLUCIDA	NITZSCHIA PUMILA	NITZSCHIA RECTA	NITZSCHIA REVERSA	NITZSCHIA SCALPELLIFORMIS	NITZSCHIA SOLITA	NITZSCHIA SP. 2	NITZSCHIA VERMICULARIS	PARAPOYNX	PINNULARIA ACROSPHAERIA	PINNULARIA BOREALIS	PINNULARIA BRAUNII	PINNULARIA GIBBA	PINNULARIA LUNDII
116	**Shoal Creek @ 24th St. (EII)**	**11/19/96**	29	0	14	0	0	0	2	0	0	33	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
117	**Shoal Creek @ Shoal Edge Court**	**11/18/96**	78	0	14	0	0	0	0	1	0	17	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0
122	**Shoal Creek Above 1st St.**	**11/20/96**	14	0	0	0	0	0	0	4	0	83	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
842	**Tannehill Creek @ Bartholomew Park**	**11/19/96**	31	0	2	0	0	0	0	0	0	35	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0
854	**Tannehill Creek @ Boggy Creek**	**11/18/96**	280	0	3	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
841	**Tannehill Creek @ Highland Mall**	**11/19/96**	4	0	0	0	0	0	2	0	0	20	0	0	0	0	0	0	6	0	0	0	0	0	0	4	0
843	**Tannehill Creek @ Lovell Drive**	**11/19/96**	27	0	0	0	0	0	2	4	0	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	**Waller Creek @ Ceasar Chavez**	**11/18/96**	26	0	5	0	2	0	0	0	0	19	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
624	**Waller Creek @ 23rd St. (USGS)**	**11/19/96**	8	0	0	0	2	0	4	2	0	20	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
780	**Waller Creek @ 51st Street**	**11/18/96**	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
781	**Waller Creek @ Shipe Park**	**11/18/96**	46	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
659	**Walnut Creek @ Lamar Blvd**	**11/20/96**	40	0	10	0	0	0	0	0	0	6	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
465	**Walnut Creek @ Loyola**	**11/21/96**	146	0	18	0	0	0	0	0	0	6	0	0	0	4	0	0	2	0	0	0	0	0	0	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	42	0	9	0	1	0	0	1	0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	56	0	0	0	0	0	0	28	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	80	0	0	0	0	32	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
464	**Walnut Creek Below IH35**	**11/20/96**	55	0	12	0	0	0	2	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
878	**West Bouldin Creek @ Jewell**	**11/20/96**	15	0	6	0	2	0	2	2	0	11	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
223	**Williamson Creek @ McKinney Falls**	**11/22/96**	4	0	0	0	0	0	0	25	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
492	**Williamson @ Nuckols Crossing**	**11/21/96**	13	0	3	0	1	0	1	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			3584	2	682	2	57	4	309	746	213	3317	2	4	8	4	12	2	113	4	2	2	3	2	9	25	2

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	PINNULARIA SP. 1	PINNULARIA STOMATOPHORA	PINNULARIA SUBROSTRATA	PLEUROSIGMA SALINARUM	PLEUROSIRA LAEVIS	REIMERIA SINUATA	RHOICOSPHENIA ABBREVIATA	RHOPALODIA GIBBA	RHOPALODIA GIBBERULA V. VANHEURCKII	RHOPALODIA OPERCULATA	STAURONEIS ANCEPS	STAURONEIS SP.1	STEPHANODISCUS PARVUS	SURIRELLA ANGUSTA	SURIRELLA BREBISSONII	SURIRELLA MINUTA	SURIRELLA PATTELLA	SURIRELLA TENERA	TERPSINOE MUSICA	THALASSIOSIRA WEISSFLOGII	Grand Total
48	Barton @ 71 Below Little Barton	11/21/96	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	500
88	Barton Creek @ Lost Creek Bridge	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	498
82	Barton Below Barton Creek Blvd	11/20/96	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	2	0	0	500
362	Blunn Creek - Preserve	11/19/96	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	500
180	Blunn Creek @ Riverside Drive	11/20/96	0	2	0	2	0	0	20	0	0	0	0	0	0	4	0	0	0	0	0	0	500
363	Blunn Creek @ Willow Run	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
364	Blunn Creek Above Stacy Pool	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
364	Blunn Creek Above Stacy Pool	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
364	Blunn Creek Above Stacy Pool	11/20/96	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	500
853	Boggy Creek @ Banton Road	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	500
837	Boggy Creek @ Nile Road	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
837	Boggy Creek @ Nile Road	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
837	Boggy Creek @ Nile Road	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
784	North Boggy Creek @ Airport Rd.	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
493	North Boggy Creek @ Delwau Lane	11/18/96	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	500
350	Bull Creek @ 360 First Crossing	11/18/96	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
350	Bull Creek @ 360 First Crossing	11/18/96	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
920	Bull Creek @ St. Ed's Park above dam	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
347	Bull Creek Above West Bull Creek	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
151	Tributary 6 @ Bull Creek (EG)	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
151	Tributary 6 @ Bull Creek (EG)	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
783	Buttermilk Creek @ Cameron Road	11/19/96	2	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0	0	0	0	500
851	Buttermilk @ Little Walnut Creek	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	500
782	Buttermilk Creek @ Providence Ave	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	500
850	Country Club Creek @ East Oltorf St	11/19/96	0	0	0	0	0	6	2	1	0	0	0	0	0	0	0	0	0	0	0	0	500

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	PINNULARIA SP. 1	PINNULARIA STOMATOPHORA	PINNULARIA SUBROSTRATA	PLEUROSIGMA SALINARUM	PLEUROSIRA LAEVIS	REIMERIA SINUATA	RHOICOSPHENIA ABBREVIATA	RHOPALODIA GIBBA	RHOPALODIA GIBBERULA V. VANHEURCKII	RHOPALODIA OPERCULATA	STAURONEIS ANCEPS	STAURONEIS SP.1	STEPHANODISCUS PARVUS	SURIRELLA ANGUSTA	SURIRELLA BREBISSONII	SURIRELLA MINUTA	SURIRELLA PATTELLA	SURIRELLA TENERA	TERPSINOE MUSICA	THALASSIOSIRA WEISSFLOGII	Grand Total
119	East Bouldin Creek @ Elizabeth St	11/20/96	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	2	500
115	East Bouldin Creek @ Riverside Dr	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
123	Fort Branch Creek @ Boggy Creek	11/18/96	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	499
126	Fort Branch Creek @ Glencrest Dr	11/19/96	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	500
125	Fort Branch Creek Above Manor Rd	11/19/96	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	500
898	Ft. Branch @ Single Shot	11/22/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	500
877	Harper's Branch @ Windoak	11/19/96	0	0	0	0	0	0	93	0	0	0	0	0	0	0	0	0	0	0	0	0	500
844	Harper's Branch @ Woodland	11/19/96	0	0	0	0	0	0	39	0	0	2	0	0	0	0	0	0	0	0	0	0	500
484	Harper's Branch Creek @ Riverside	11/19/96	0	0	0	0	0	0	33	0	0	0	0	0	0	1	0	0	0	0	0	0	500
847	Johnson @ South Tarrytown	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	20	2	0	0	0	0	0	500
847	Johnson @ South Tarrytown	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
838	Little Walnut @ Golden Meadow	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	8	500
839	Little Walnut Creek @ Hermitage	11/20/96	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	502
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
634	Little Walnut Creek @ US183	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
840	Little Walnut Creek @ US290	11/21/96	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	2	500
883	Onion Creek @ FM 973	11/18/96	0	0	0	3	0	29	0	0	0	0	0	0	0	3	0	6	0	0	0	2	500
883	Onion Creek @ FM 973	11/18/96	0	0	0	4	0	60	0	0	0	0	0	0	0	6	0	2	0	0	0	2	500
255	Onion Creek @ McKinney Falls	11/18/96	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	500
255	Onion Creek @ McKinney Falls	11/18/96	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	0	0	0	0	500
220	Onion Creek @ Old Lockhart Hwy	11/18/96	0	0	0	21	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
236	Onion Creek @ Twin Creek Bridge	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
236	Onion Creek @ Twin Creek Bridge	11/18/96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
239	Onion Creek Above IH35 (OC2)	11/18/96	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
239	Onion Creek Above IH35 (OC2)	11/18/96	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500

Appendix E - 1996 EII Diatom Data
(Counts)

Site #	Sample Site Name	Date	PINNULARIA SP. 1	PINNULARIA STOMATOPHORA	PINNULARIA SUBROSTRATA	PLEUROSIGMA SALINARUM	PLEUROSIRA LAEVIS	REIMERIA SINUATA	RHOICOSPHENIA ABBREVIATA	RHOPALODIA GIBBA	RHOPALODIA GIBBERULA V. VANHEURCKII	RHOPALODIA OPERCULATA	STAURONEIS ANCEPS	STAURONEIS SP.1	STEPHANODISCUS PARVUS	SURIRELLA ANGUSTA	SURIRELLA BREBISSONII	SURIRELLA MINUTA	SURIRELLA PATTELLA	SURIRELLA TENERA	TERPSINOE MUSICA	THALASSIOSIRA WEISSFLOGII	Grand Total
116	**Shoal Creek @ 24th St. (EII)**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	500
117	**Shoal Creek @ Shoal Edge Court**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
122	**Shoal Creek Above 1st St.**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	8	2	0	0	0	0	20	500
842	**Tannehill Creek @ Bartholomew Park**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	500
854	**Tannehill Creek @ Boggy Creek**	**11/18/96**	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	501
841	**Tannehill Creek @ Highland Mall**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	500
843	**Tannehill Creek @ Lovell Drive**	**11/19/96**	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
38	**Waller Creek @ Ceasar Chavez**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	500
624	**Waller Creek @ 23rd St. (USGS)**	**11/19/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	500
780	**Waller Creek @ 51st Street**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
781	**Waller Creek @ Shipe Park**	**11/18/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
659	**Walnut Creek @ Lamar Blvd**	**11/20/96**	0	0	0	0	0	5	0	0	0	0	0	0	0	9	2	0	0	0	0	5	500
465	**Walnut Creek @ Loyola**	**11/21/96**	0	0	0	2	0	52	0	0	0	0	0	0	0	0	4	0	0	0	0	0	504
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	0	1	0	0	0	0	0	0	0	2	2	0	0	0	0	0	500
503	**Walnut Creek @ Railroad Bridge**	**11/21/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
500	**Walnut Creek @ Springdale Rd**	**11/20/96**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75
464	**Walnut Creek Below IH35**	**11/20/96**	0	0	0	0	1	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	500
878	**West Bouldin Creek @ Jewell**	**11/20/96**	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	500
223	**Williamson Creek @ McKinney Falls**	**11/22/96**	0	0	0	0	0	1	6	0	0	0	0	0	0	2	0	0	0	0	2	1	500
492	**Williamson @ Nuckols Crossing**	**11/21/96**	0	0	0	0	0	14	2	5	0	0	0	0	0	0	0	0	0	0	0	0	500
			2	4	2	33	1	266	199	21	2	2	2	2	44	304	12	8	4	2	2	62	52138

Appendix E - 1996 EII Chlorophyll a Data

Site #	Sample Site Name	Date	Chlorophyll-a	Pheophytin	Volatile Suspended Solids
			mg/L	mg/L	mg/L
48	Barton Creek @ Hwy 71 Below Little Barton	11/21/96	<0.067	1.2	950
88	Barton Creek @ Lost Creek Bridge (BC10)	11/20/96	<0.067	0.82	340
52	Barton Creek Below Barton Creek Blvd	11/20/96	<0.067	0.88	310
362	Blunn Creek - Preserve at Little Bridge	11/19/96	1.6	0.79	800
180	Blunn Creek @ Riverside Drive	11/20/96	0.83	0.61	660
363	Blunn Creek @ Willow Run	11/19/96	0.28	0.84	410
364	Blunn Creek Below Stacy Pool	11/20/96	1.1	0.57	420
364	Blunn Creek Below Stacy Pool	11/20/96	<0.067	1.5	290
853	Boggy Creek @ Banton Road	11/19/96	0.68	1.4	620
837	Boggy Creek @ Nile Road	11/18/96	0.71	0.71	1040
837	Boggy Creek @ Nile Road	11/18/96	0.25	0.6	420
784	North Boggy Creek @ Airport Rd.	11/19/96	4.4	<0.067	750
493	North Boggy Creek @ Delwau Lane	11/18/96	<0.067	0.31	190
350	Bull Creek @ Loop 360 First Crossing	11/18/96	0.073	0.89	760
350	Bull Creek @ Loop 360 First Crossing	11/18/96	0.25	0.5	910
920	Bull Creek @ St. Ed's Park above dam	11/20/96	<0.067	1.5	800
920	Bull Creek @ St. Ed's Park above dam	11/20/96	0.98	0.99	1000
347	Bull Creek Above West Bull Creek	11/18/96	0.31	0.33	1070
151	Tributary 6 @ Bull Creek (EG)	11/19/96	<0.067	1.8	540
783	Buttermilk Creek @ Cameron Road	11/19/96	0.19	0.37	320
851	Buttermilk Creek @ Little Walnut Creek	11/20/96	1.9	1.1	660
782	Buttermilk Creek @ Providence Ave	11/19/96	0.23	0.64	420
850	Country Club Creek @ East Oltorf St	11/19/96	<0.067	0.7	500
119	East Bouldin Creek @ Elizabeth St	11/20/96	1.1	0.35	520
115	East Bouldin Creek @ Riverside Dr	11/20/96	2.3	0.9	590
123	Fort Branch Creek @ Boggy Creek	11/18/96	<0.067	<0.067	40
126	Fort Branch Creek @ Glencrest Drive	11/19/96	<0.67	3.5	820
125	Fort Branch Creek Above Manor Rd	11/19/96	0.59	0.24	430
898	Ft. Branch @ Single Shot	11/22/96	<0.067	<0.067	90

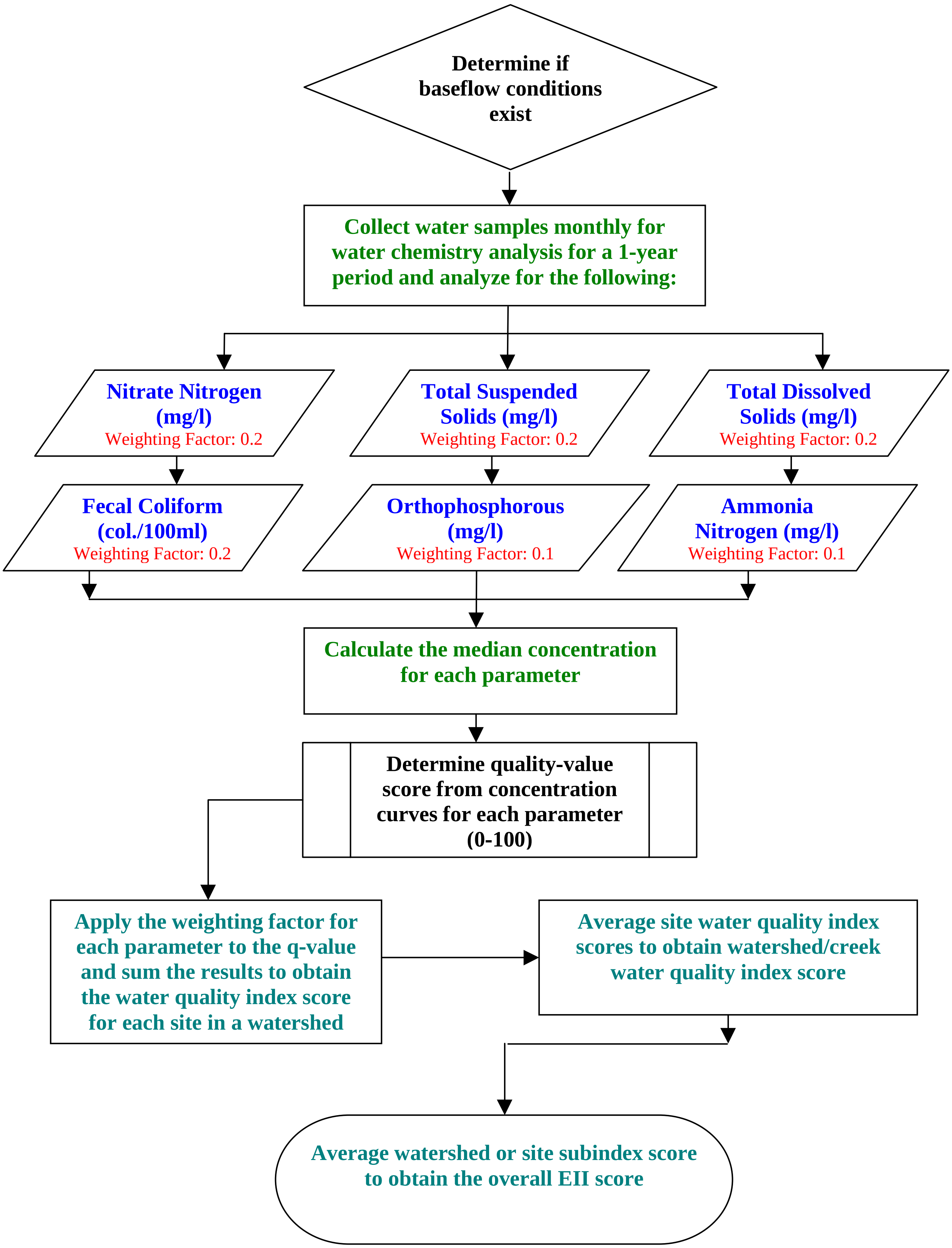
Appendix E - 1996 EII Chlorophyll a Data

Site #	Sample Site Name	Date	Chlorophyll-a	Pheophytin	Volatile Suspended Solids
			mg/L	mg/L	mg/L
877	Harper's Branch @ Windoak	11/19/96	0.51	0.82	610
844	Harper's Branch @ Woodland	11/19/96	2.2	1.1	660
484	Harper's Branch Creek @ Riverside Dr	11/19/96	0.43	0.089	410
838	Little Walnut Creek @ Golden Meadow Rd	11/20/96	3	1.2	1320
839	Little Walnut Creek @ Hermitage Drive	11/20/96	1.5	0.72	480
634	Little Walnut Creek @ US183	11/21/96	<0.067	0.39	90
840	Little Walnut Creek @ US290	11/21/96	<0.067	1.9	450
883	Onion Creek @ FM 973	11/18/96	0.093	0.29	520
883	Onion Creek @ FM 973	11/18/96	0.44	<0.067	440
255	Onion Creek @ McKinney Falls	11/18/96	<0.067	1.5	510
220	Onion Creek @ Old Lockhart Hwy (ON4)	11/18/96	<0.067	0.35	320
236	Onion Creek @ Twin Creek Bridge (OC1)	11/18/96	<0.067	0.44	330
239	Onion Creek Above IH35 (OC2)	11/18/96	<0.067	0.3	280
116	Shoal Creek @ 24th St. (EII)	11/19/96	3	0.18	860
118	Shoal Creek @ Crosscreek Drive	11/19/96	0.31	2.2	930
117	Shoal Creek @ Shoal Edge Court (EII)	11/18/96	0.1	0.87	180
122	Shoal Creek Above 1st St.	11/20/96	1.7	1	650
842	Tannehill Creek @ Bartholomew Park	11/19/96	1.6	0.45	930
854	Tannehill Creek @ Boggy Creek	11/18/96	0.24	<0.067	400
841	Tannehill Creek @ Highland Mall	11/19/96	1.2	1.1	840
843	Tannehill Creek @ Lovell Drive	11/19/96	0.15	0.34	260
38	Waller Creek @ Ceasar Chavez	11/18/96	0.43	0.52	480
624	Waller Creek @ 23rd St. (USGS)	11/19/96	1.6	0.17	500
780	Waller Creek @ 51st Street	11/18/96	0.3	0.45	890
781	Waller Creek @ Shipe Park	11/18/96	0.22	0.3	440
659	Walnut Creek @ Lamar Blvd	11/20/96	2	1.6	900
465	Walnut Creek @ Loyola	11/21/96	1.7	0.64	750
503	Walnut Creek @ Railroad Bridge	11/21/96	<0.067	0.55	280
500	Walnut Creek @ Springdale Rd	11/20/96	0.47	0.86	270

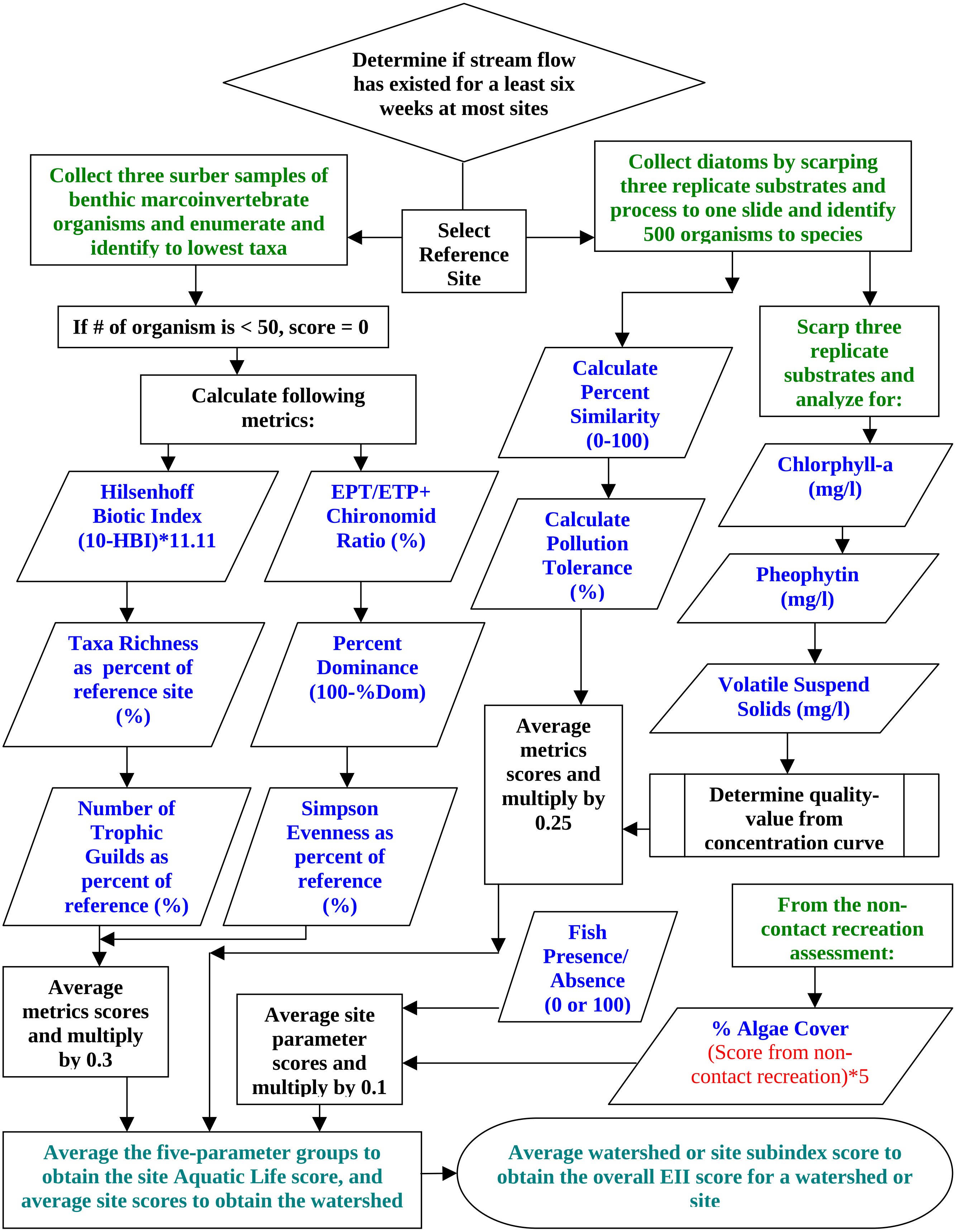
Appendix E - 1996 EII Chlorophyll a Data

Site #	Sample Site Name	Date	Chlorophyll-a	Pheophytin	Volatile Suspended Solids
			mg/L	mg/L	mg/L
464	Walnut Creek Below IH35	11/20/96	2.2	1.4	1060
464	Walnut Creek Below IH35	11/20/96	1.7	1.3	1530
878	West Bouldin Creek @ Jewell	11/20/96	0.61	0.55	520
223	Williamson Creek @ McKinney Falls (Will1)	11/22/96	0.87	1.2	560
492	Williamson Creek @ Pleasant Valley (W2)	11/21/96	0.82	0.84	1320

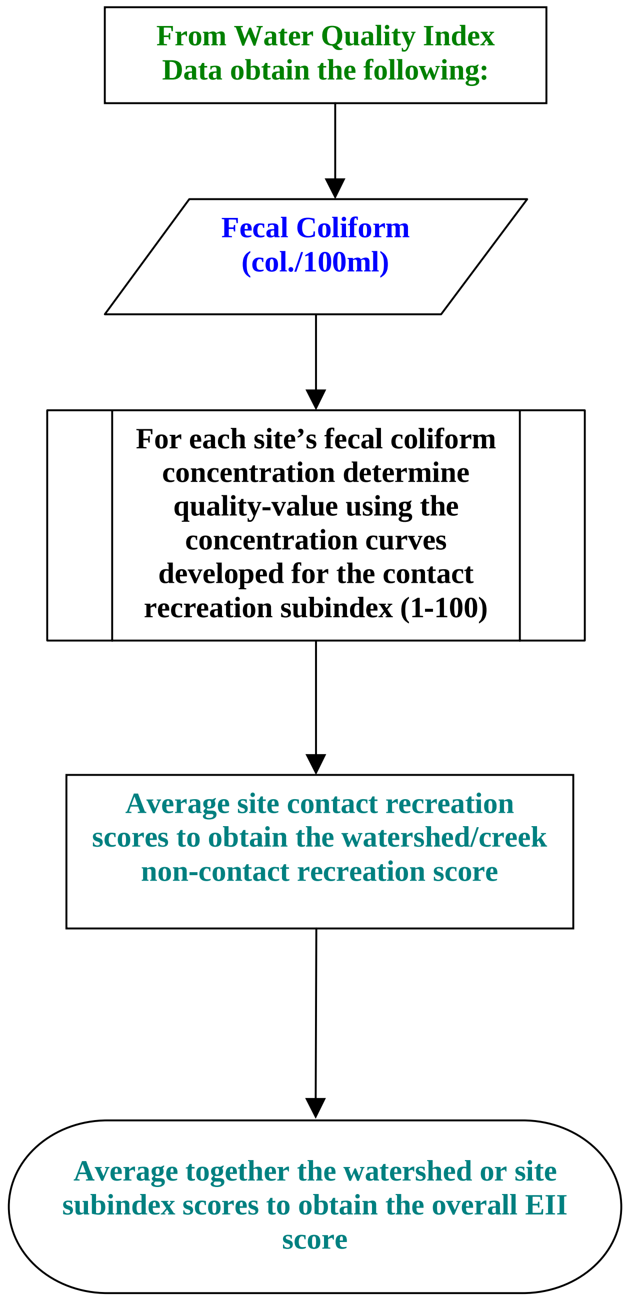
WATER QUALITY INDEX



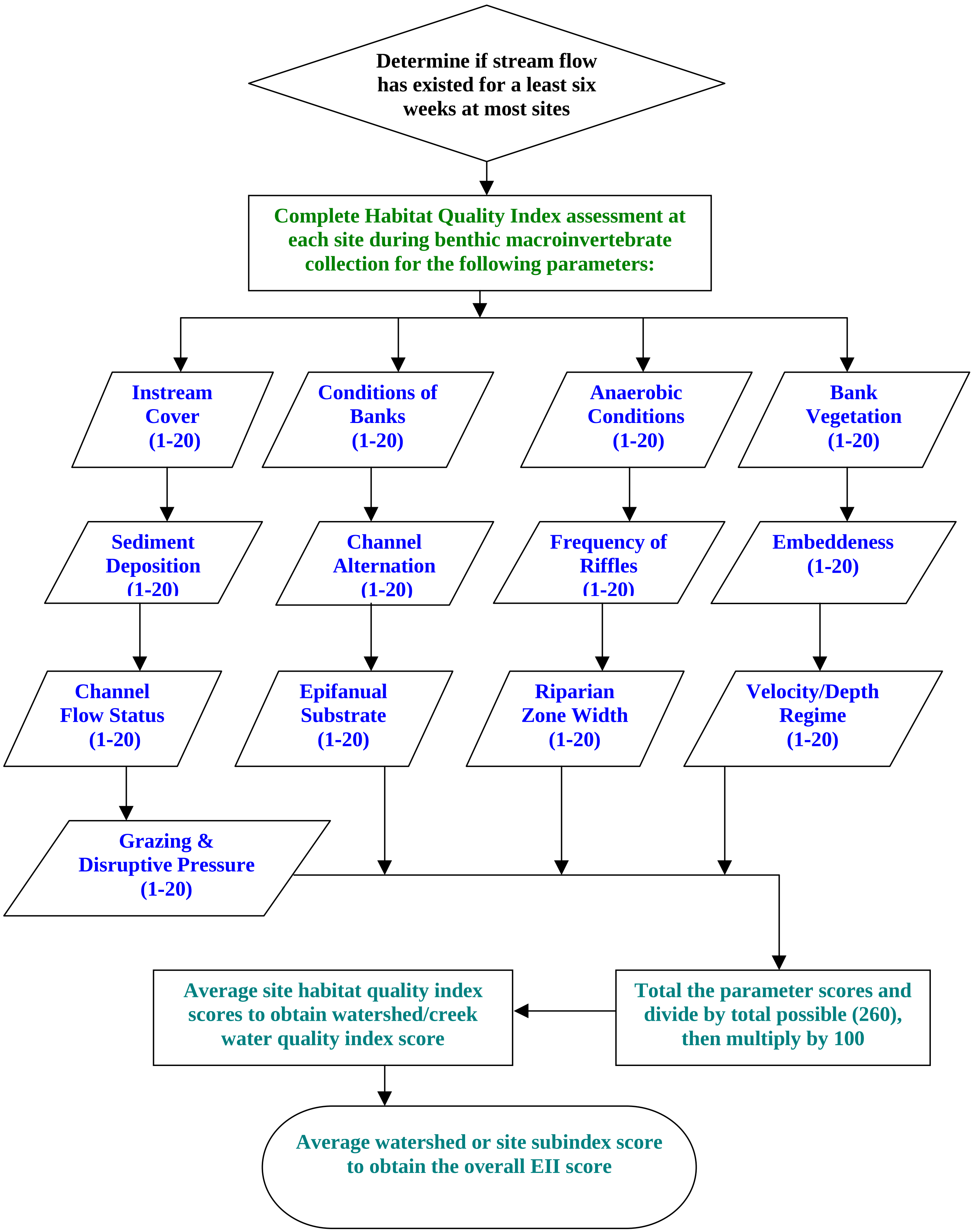
AQUATIC LIFE SUPPORT INDEX



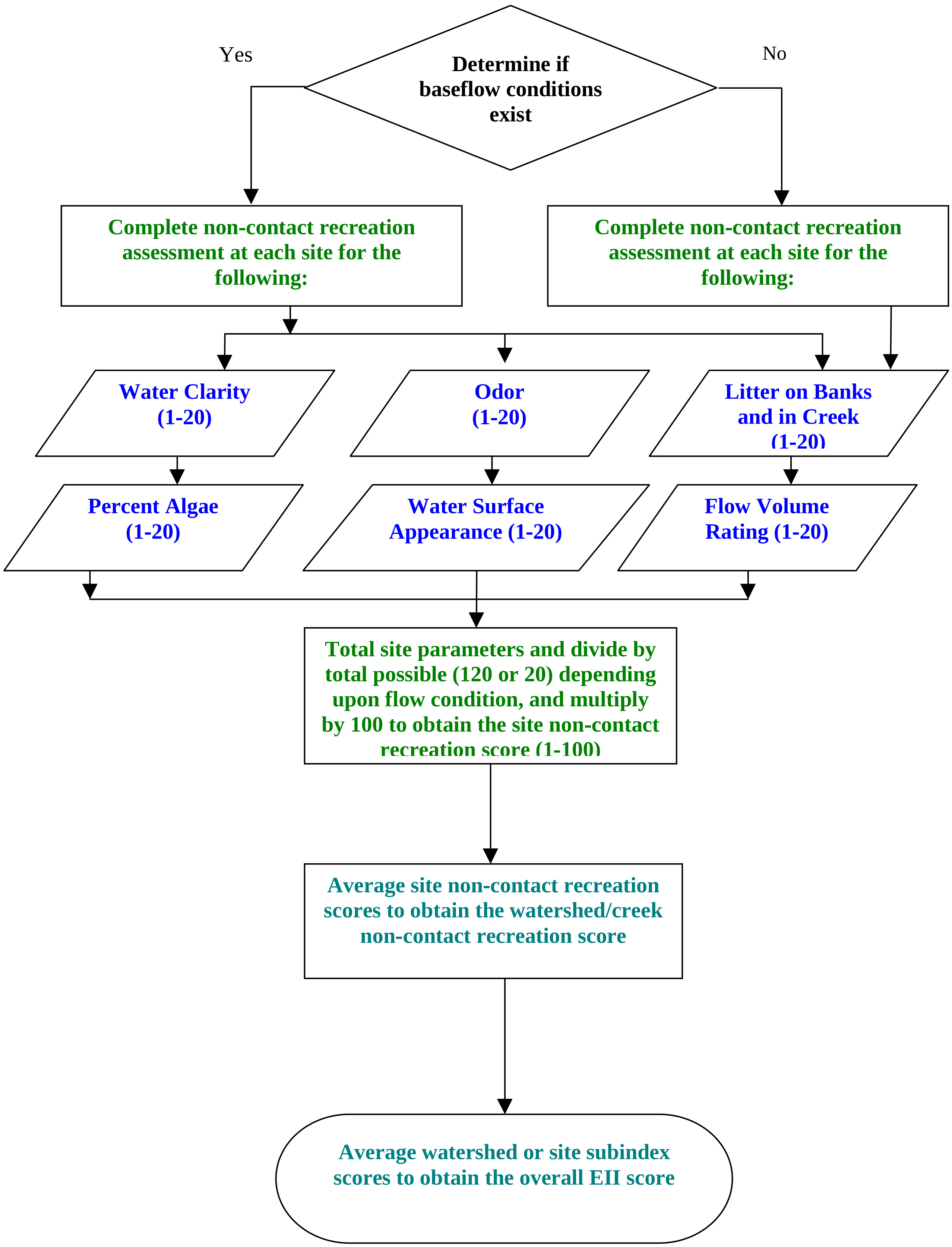
CONTACT RECREATION INDEX



HABITAT QUALITY INDEX



NONCONTACT RECREATION INDEX



SEDIMENT QUALITY INDEX